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Editorial Comment

EDITORIAL

The problems associated with planning and carrying out research are many, varied and complex particularly when the variables that have to be examined or controlled are social or behavioural. Data collection in these areas is on the one hand complex and difficult but on the other too easy. There are people who contend that the most serious problem confronting educational research generally is the apparent ease with which large quantities of data can be quickly collected, with questionnaires, interest blanks and similar instruments all of which tend to be plagued by the subjectivity of the respondents. Even the most carefully constructed instruments are not immune from doubt with respect to reliability and validity. The many studies which use and depend upon "researcher designed" instruments are always suspect and frequently possess little more than "faith" validity.

This is a situation with which we have to live but constant vigilance must be maintained to ensure that we do not learn to live contentedly with what is a scientifically unsatisfactory situation. It is probably true to say that only out of the rubble of bad measuring instruments will better ones be constructed and it is evident that improvements are being effected. The behavioural and social sciences have made outstanding contributions to research methodology in such fields as sampling theory, factorial analysis, probability theory and many others but complacence with respect to the inadequacy of the measuring instruments would be disasterous.

The research literature contains little informed constructive criticisms of reported research and perhaps journal editors have not sufficiently encouraged critical discussion. For this reason the article authored by M. A. Nay and C. K. Brown may be significant. It was composed as a result of an invitation issued by the editor and is offered in good faith partly to show one type of discussion and, perhaps more importantly, to demonstrate that the pages of this journal are open to such material.

Several of the articles published in this issue are directed toward aspects of research that are important prior to research or toward factors important in the rigorous pursuit of pertinent and valid research. Robert Lawson calls attention to the vagueness associated with three concept-carrying terms and by implication suggests that research into, and understanding of, the areas will not be achieved unless clearer delineation is attained. Holdaway and Seger suggest that inequalities occur in education provisions for students in different socio-economic strata in spite of genuine belief by administrators that adequate safeguards are being applied. The problem is basically one of the influence of role expectations on the provision of staff and faculties. Schools in the higher socio-economic areas tend to be expected to perform more effectively and tend to be provided with facilities that increase the probability of their doing so. Consequently the way in which a particular school's status is seen tends to influence the way in which it is treated even though no discrimination is intended.

Lee Hoxter's article is theoretical and although it is concerned with issues that have been widely and frequently considered they are issues that tend to be inadequately understood by many who are concerned with research in educational and behavioural science. Practically oriented personnel tend to continue to lack understanding not only of the theoretical issues but also of the importance of theory that underlies both research design and practical application. The terms 'model', 'intervening variable', 'theoretical construct' and 'operationism' and their many cognates are freely used but inadequately understood except by the specialists. Publication of Hoxter's article is one more indication of the function of this Journal to educate in a wide sense rather than to merely provide an avenue for research reporting.

Professional Journals would be remiss if they did not provide the members of the profession to whom they are directed with opportunities to "try out" ideas with their colleagues. The article by Guy Lefrancois falls in this category and should be read as a preliminary exposition of an idea—an idea that may or may not be fruitful. Publication provides the author with the opportunity to express his ideas briefly and invite criticism that may lead toward a more fruitful work.

Linton, MacGregor and Storey have provided reports of research undertaken in their respective fields of interest. Art and Art Education are fields which have not been typified by empirical research to justify or explain the approaches taken and therefore MacGregor's article may be welcomed by many readers.

. . . . . .

The steady flow of manuscripts which has increased in volume and quality during recent months is enabling a better range of types and aspects of research and research related material to be offered in each issue than prevailed as recently as a year ago. This is encouraging not only in terms of the status of the publication but also as an indication of

the growth of research. Present indications are that it will soon be possible to plan each issue in advance and ensure that each contains articles representative of a specified range of types. This should enhance the growth of the range of readership.

The change in size and layout of the Journal which was initiated in March, 1967 increased publication costs considerably. However, a comparison between income and expenditure for 1965 (Vol. XI) and 1966 (Vol. XII) reveals that the excess of expenditure over income and hence the cost to the sponsoring institutions decreased from $3,450 to $1,800. This change is due to increased subscriptions and subscription rates, revenue from advertising and changes in policy for exchange and complimentary copies. The situation is most gratifying to the editor and his associates who were responsible for the decision to make the changes but credit must also be given to the subscribers many of whom have assisted in the quest for increased sales.

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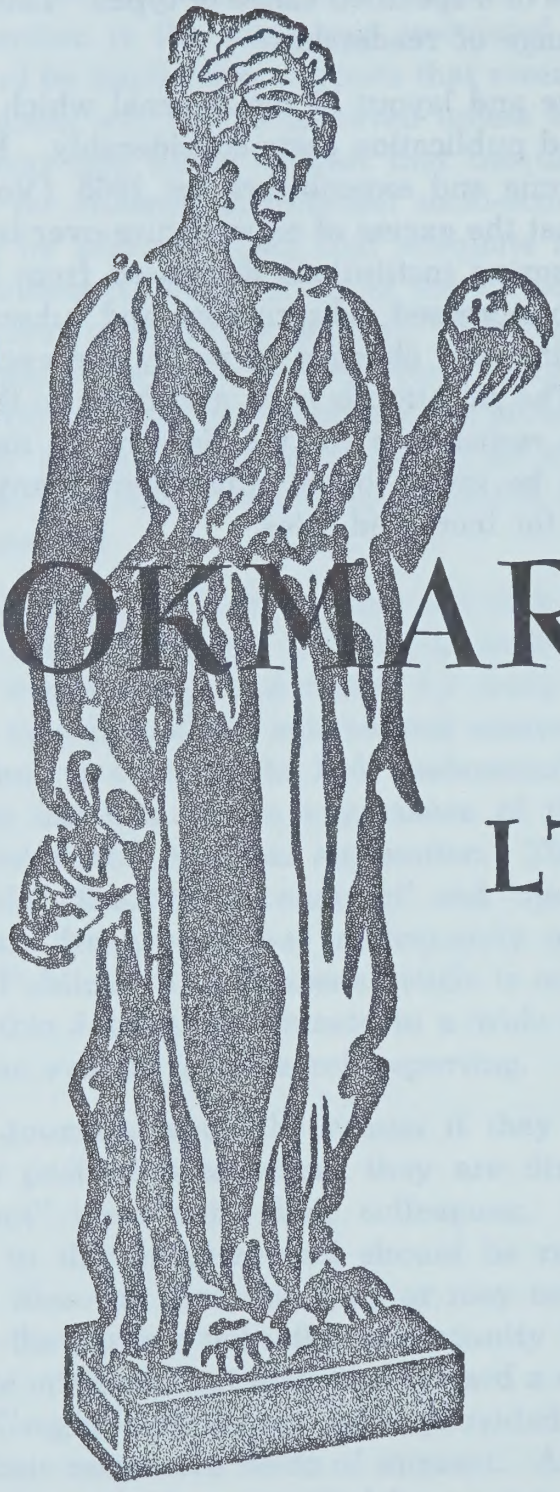

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Philosophers have always striven to specify precisely the referents associated with concept denoting terms. Increased concern with this dimension of enquiry has occurred since the use of scientific philosophy during this century but only recently have educational philosophers become involved. In this article Dr. Lawson considers three terms and indicates the influence on educational policy and practice which vague delineation of the concepts associated with them is having.

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Observations on Three Concept-Carrying Terms

Presumably educational researchers define the terms they use; educational leaders are now sophisticated enough to communicate clearly the ideas of education through specific terms; and the literate populace of the western world, served by highly developed systems of mass communication, can, as a whole, receive and understand even terms referring to complex and involved ideas and practices. These, and the linking groups in between, have, as an essential part of the socialization process, become accustomed to using linguistic shortcuts in the form of terms, to convey with some efficiency the complex information of an advanced scientific, urban culture. In education, moreover, professional efforts, at the research and policy-making levels as well as at the instructional level, are based on the use of communicable and operative terms, which refer unambiguously to the content, institutions, relationships and ideas of education.

However, the fact is that communication in and about education is still hindered by disagreements arising out of definitional vagueness. Reasons for this have been identified analytically and practically by educators from the point of view of their particular interests, but two qualifications to the objective, unambiguous use of educational terms are

basic and applicable to the present discussion. First, educational terms have connotations which are connected to the emotional "terminals" of the hearer; they are personal as the closest cultural constructs are personal, and they are personal as one's own children are personal. Thus, the common interpretation of a given term will be fundamentally conservative or will accord with individual interests and social predilection. Second, that education is, as an institution and as a network of ideas, a political instrument, used by leaders to socialize youth to a system and to perpetuate a political order, both by means of interaction and by value-informational ends. Political leaders, then, whether in a political, educational, or other institutional seat, will intentionally interpret terms to accord with the order and direction of political activity, and will manipulate the definition and subsumed information to operate practically in favour of system goals. The former is not so self-centred nor is the latter so evil as it may sound. The role of Education as a stabilization and integration device, for the benefit of the individual and the polity, may well require these covert or sub-surface modifications to "pure" information. However, there is no doubt that this subversive action clouds educational communication and obstructs forward movement, implied in research and threatening the established machinery of and functions for education.

There is much more to be said on this, but for the present purpose, I wish only to criticize the use of three terms vital to the definition of education in Alberta, and to suggest a clarification based on my own theoretical understanding of their use.

I. 'Social Studies'

Because of inadequacies in the teaching and planning of Social Studies curricula; because of subtle changes in the content subsumed under the heading, and because of a recent emphasis on discipline and structure, the term, 'Social Studies,' rarely applies to the courses of that name. These courses are usually history or geography courses, and though they may be stipulatively named anything, there seems to be no necessity of fuzzying the description of content which has been accurately described by traditional terms. This suggests that the content in this area has undergone little change, and I believe this is the case.

Superficial units in the early grades on such things as "community helpers" do not alter the case. As taught, they should be a part of preschool experience, as indeed they are informally for most children. Parenthetically, extensive preparatory learning in social as well as intellectual spheres has become indispensable and clearly indicates the need for a systematized kindergarten organization. In the school curriculum, however, "common-sense" everyday-experience learning belong in a

course of social study only as facts or illustrations in a theoretical framework. They must represent ideas, procedures, relationships, which other specific items will also represent, and which in this framework will ultimately provide the essential comprehension for mental and social sanity in a very complicated present environment.

This is getting close to an operational definition of Social Studies. As we get away from the isolated, common-sense, over-simplified unit, however, teachers move back to the intellectual discipline of an established subject and liberalize its traditional form by emphasizing a neglected aspect or introducing a parallel line of inquiry. Thus, the higher grades may offer courses in social history or human geography—but these are still not Social Studies as a subject. Useful as these may be, they are nonetheless properly characterized by the content and procedure of the basic discipline. If Social Studies must have an academically tried basis, then it might well rest on Sociology, Social Anthropology, or Social Psychology—but there is no reason why Social Studies cannot have a structure of its own. To say it has none, or that the concept has "failed," is only to say that the content has not been organized properly, presented adequately, or made meaningful conceptually.

Social Studies was once conceived as the integration of learnings in the social sciences which was necessary to confront the child and youth with the facts of life and society indispensable for healthy participation. The intent was to provide learning of those skills, attitudes, and knowledge which would encourage responsible citizenship and personal fulfilment in an industrial society. It was not only primarily a body of information, but a way of thinking and of behaving. At its best, Social Studies might be termed the moral education for democracy.

I see no change in society or education which makes these requirements less urgent for the school. However, that is a value statement; the point here is that the subject either is defined in terms of the methods, goals, and content of Social Studies, or it is given an older or newer name. *Social Studies* does have a recognized identity.

In Alberta schools, the subject so named does not have this identity. It is, for the most part, either a string of exercises related to "common sense" experience, which I have relegated to the pre-school period, or it is a modified form of a traditional subject. The term, however, does have the unique identity I have suggested when it is used in educational and official publications. And in its common usage among school people, it has yet another sense, that of a blanket term for all courses generally in the area of the social sciences and even some in the humanities. Many lengthy discussions about Social Studies would end before they started if the terms for courses were explicit, and the writing and talking about these offerings were equally explicit.

II. 'Community College'

The term, 'Community College,' also has specific referents, but unfortunately it is used loosely and, most confusing, interchangeably with *junior college*. This is not surprising since both are relatively new institutional forms and both draw their students from the surrounding community, i.e., they both in some sense "serve the community."

However, the junior college is largely a modification of the existing educational structure and does not depart essentially from the academic-ladder principle. Both name and form parallel the development of the junior high school, which came into being as a transitional stage between elementary and high school—transitional between neighborhood and community district, between stages of psychological and intellectual maturity, between uniform and diversified learning experiences, and transitional into various life and occupational directions. It might even be said that the extension of mass schooling upward into the secondary level occasioned the transfer of junior-high-school theory to a new point of decision between secondary and higher education—the junior college.

Just as the junior high school was able to become more experimental and innovative than the regular high school, the junior college, supported by the liberal, expansive temper of high schools and, to some extent, universities in its formative period, was able to offer courses and programmes in areas and to students not generally reached by more traditional higher education. Nevertheless, it was fundamentally an academic institution, as the name indicates—a junior-level liberal arts college. Thus, with a fully developed junior-college system, the structure of the school ladder would become 6-3-3-2, or something similar, depending on the breaks in the pattern. It might be a terminal school for some but much of the programme and form of the institution was determined by the requirements of universities into which students should be able to move with facility, or even by the aspiration of the junior college itself to become a regular four-year college.

The Community College, on the other hand, has no such program, level, or student-body restrictions. It is only incidentally related to the regular educational system through the use of school buildings, and other educational resources, human included, of the community. But its place is with the more informal learning contexts, such as adult-education centres and extra-curricula school programs. Its closest institutional parallel is in the Scandinavian folk high schools.

The service function of the Community College is direct and immediate, offering anything which people want provided only that facilities and staff are available in the community and that it can be termed educational in the broadest sense. Its purposes include such unorthodoxies as bringing people together for better human understanding, recreating

bodies and minds through play, games and sport, catering to whole families, individually and together and, preparing children and adults to profitably use their leisure hours in satisfying and possibily productive ways. Incidentally, these purposes have not been absent in school theory, but they somehow fall out in practice. The practice in the Community College is as broad as the social universe of the community. Indeed, it might be said that the college is the community and a going programme will ensure as much as possible that all members of the community constitute the student body.

The cities in Alberta have not moved into a community college programme. The province is moving rapidly into a large-scale junior college operation and, this is itself interesting enough for an article. Again, however, the point is clarity in our terminology. There are a good many significant innovations in community development, community social work, community adult education, etc., but these are not indicative of a community college movement. Nor is it requisite to educational development in Alberta that they be so. There are alternative ways of achieving the social and educational ends of the community college—and up to now, apparently, alternative ways have been chosen.

III. 'Selection'

The term, 'selection', finally, is one which signifies a process of singling out individuals or groups of individuals for distinctive educational treatment. Its history is as long as that of education itself and it has always been an integral part of systems, formal and informal. Its employment is world wide even today and though there is a great deal of controversy about the component issues, there seems to be no way to avoid selecting in education, save for the uniform instruction of genetically homogeneous men with *iso*-abilities and goals for a conformity of social life and production.

Thus, when the statement is made that there is "no selection" in a given educational system, it simply means that certain restrictive procedures barring entrance to an advanced level of education are not employed; that children grouped on the basis of certain criteria, usually verbal-academic, are not separated physicaally into schools identified by the grouping criteria; that division of students does not take place at what appears to the spokesman to be an unjustifiably early age; or that *preferential* selection on the basis of favoured social classes, family backgrounds, economic advantages, intellectual capacity, or types of skills is not practised.

It will be seen immediately that these procedures and criteria are not all absent from the educational system of any nation in the world. Hence, *selection* cannot be used as a value or theory term, but must be

investigated as an operational term, exactly defined by the system practices and goals. Certain allegations are made regarding the absence of selective criteria or procedures, usually to make a value point, such as the standard of democracy in education but they are untrue, logically invalid, or practically impossible, hence unimplemented, or simply inaccurate usage of language.

If, however, all the qualifying statements did pertain to a given system, i.e., free access to the next level of education was granted every pupil, no continuous grouping of children was attempted, all schools were comprehensive, including all pupils at a given level and all possible curriculum offerings, and equal attention were given all competencies, talents, and career directions, we would have an incredibly complex system and yet, one to which most nations of the world are today aspiring—some few with considerable success toward achieving it. Nevertheless, there is selection as long as some means, even self-selection, is employed to separate groups of children for learnings not pursued by another group.

This more objective kind of selection, based on the principle of equal opportunity to be unequal, to be educated according to one's unique characteristics and goals—whatever they may be—has become termed *differentiation* as opposed to selection. This is a helpful refinement, as long as one accepts selection as meaning one thing and differentiation as meaning something else.

This is not a case of calling a horse a cow. I have no intention of advocating a multiplicity of terms or a new jargon for "in" educators. *Social Studies* should differ substantively and linguistically from *history;* so should *differentiation* differ from *selection.* Otherwise, there is no need for another term. However, if selection is not only the general term referring to the separative procedures employed by schools, but also carries a connotation of rigidity, class distinction, bureaucratic restriction, and the like, and these referents are useful in some applications of the term, then obviously, another term is necessary to indicate the procedural and theoretical departure from the basic operaation. In effect, differentiation would mean the *kind* of open selection which school systems are by and large trying to achieve. A caution is still necessary, however. *What* a system actually does in differentiating *or* selecting is always uniquely circumscribed by the theory and operation of education in that system. The reference is still to a basic procedure of separation and does not imply a uniformity in details of implementation.

In any case, the school system in Alberta is not unselective, even in the grossest sense of the term, and unless the term is qualified or restricted to a specified meaning, there can be no adequate confrontation with the issues involved. The issues involved in each of the examples

discussed are serious and important. They will not be resolved by a clarification of terminology, but they may be attacked at least.

This brief attempt has been directed toward opening up three commonly used educational terms to closer scrutiny and toward producing a statement which might stand between the term and the practice to which it refers. There is no pretense here that the observations presented do not indicate a conceptual bias nor that they avoid an implication for action. It should be clear that, for effective educational communication, there is a necessity for commitment to a theoretical position and to a course of action. The objectivity lies in the reference of the terms used, not in the "coldness" of ideas or processes involved.

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It can be hypothesized that the production of more rigourously designed and executed research can only be encouraged by informed criticism of published studies. The authors of this article have attempted to provide this service for a manuscript previously published in this Journal. Their comments on the limitations of the design and methodology of the study are seriously offered and well taken and they are to be commended for performing a role that so far is too often absent from the pages of professional publications.

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Remarks on "Knowledge of Science and Teaching Behaviour"*

The signal feature of educational research of the past few decades is the paucity of significant findings. Included in this indictment are the investigations into the act and outcome of teaching, since most of them have been largely exercises culminating in the statistical game of "no significant difference". Specifically, nothing definitive has resulted from research into "teacher effectiveness". Comparative studies in teaching methodology (including the use of the laboratory in teaching science) have proved fruitless. Neither subject matter competence (beyond an undefinable minumum) nor up-dating of science curricula have been shown to be significant in relation to a pupil's immediate achievement or his subsequent advanced studies.

Eccles has ventured into this quicksand of educational research and has come up with the expected results. In an earlier study, she sought to determine the correlation between "teachers' knowledge of science and the restricted criterion of successful teaching represented by student achievement on examinations . . . at the sixth grade level".[1] There was

*P. J. Eccles, *The Alberta Journal of Educational Research*, Vol. XII, No. 2, June 1966, Pp. 141-156.

no significant correlation. The purpose of her more recent study was to compare "two groups of teachers in terms of what they did in the classroom as they went about teaching science", one group purportedly having a weaker background in science than the other.[2] A wide range of parameters was included: number of lessons missed, errors committed, use of technical vocabulary, use of class time for administrative purposes, the amount of teacher talk, the amount of student talk, the use of audio-visual aids, monologue and note-giving, the use of demonstrations and experiments and, use of reference books. The general conclusion reached in the latter study was that "there was no significant difference between High and Low group teachers for any of the variables considered".

One focal point of criticism of this investigation must be the experimental design and execution. However, perhaps a more important focal point of criticism is the conception and formulation of the problem investigated. In our opinion, Eccles has done a valuable piece of work, but has encumbered it with such amorphous notions as "teacher effectiveness" and "subject matter competence". It should be possible to restate the problem and re-interpret the data of the study in terms of "teaching as it is", whence it may be grouped with similar studies of the teaching act made by Flanders,[3] Bellack,[4] Amidon,[5] Smith,[6] Taba,[7] and others.

Remarks on the Design and Procedure

Eccles raises an important but seemingly unanswerable question: "How much science does a teacher need to know in order to teach the subject effectively in the intermediate grades?"[2] She states further and, perhaps tritely, that "common sense . . . insists that knowledge of subject matter is essential for the teacher". This presumabbly leads to the assumption that teaching style or behaviour is related to the knowledge of the subject matter a teacher has. However, the data do not support the assumption.

At this point one might ask a related question: What is meant by knowledge of science? If we mean only knowledge of factual material, then the next question is "Why should adequate knowledge of factual material be related to teaching behaviour or style?" Factual knowledge has nothing inherent in it to dictate the mode of teaching. However, if we see knowledge of science in terms of its structure as delineated by Schwab, it might be that a discipline would dictate in part the mode of teaching. According to Schwab, the structure of science consists of the *substantive* aspect (ideas, conceptual schemes, modes of organization, limitations, et cetera) and its concomitant *syntactical* one (problems posed or evidence required by a discipline, modes of inquiry or how data are obtained, problems of interpretation, et cetera).[8,9] To know science is also to know the unity and interplay of substance and syntax.

Consequently, it may be assumed that teaching behaviour would be moulded considerably by a teacher's knowledge if, in addition to the ideas of science, the strategies of coming to know them were included. The science curricula used in the elementary grades in Alberta emphasize factual material. Inquiry or experimentation by students is not required, nor was this dimension brought into the teaching voluntarily by the majority of the teachers in Eccles' sample. Consequently, an investigation which uses a narrow conception of "knowledge of science" as a major parameter runs a greater risk of yielding a conclusion of "no significant difference". The connection between teaching behaviour and knowledge in a discipline as defined by Schwab has yet to be determined.

Eccles' procedure in classifying teachers into categories of knowledge-ability can also be questioned. Only one test was administered on the basis of which knowledge of science was judged. No other standardized science test was used to confirm the ratings obtained on the test administered. No measure of scientific attitude, or of understanding of scientific process was used. The possible distortion of the findings as a result of "drop-outs" from the original group is acknowledged. However, in view of the limited testing, these "drop-outs" cannot be construed as the less knowledgeable teachers. Finally, it is noted that the teachers in the Low group scored in the 84th percentile of grade XII norms. It would appear that their competence in science was, on this measure, at least adequate for the level (grade 6) and nature of the course taught. Increased subject matter competence beyond this level would probably not be expected to produce differences. In fact, the author acknowledges that when the teachers "entered the classroom they had mastered the content they intended to teach."[2]

Most research in science teaching has utilized pupil achievement as one of the variables. Eccles followed this pattern in her first study, although one may question her use of an undefined achievement test. She should have used a test of measured reliability, and one in which items were included to test a wide range of cognitive skills (e.g., according to Bloom's Taxonomy).[10]

Unfortunately, not only is there usually an insignificant correlation between standard measurements of achievement and knowledge of subject matter but also between achievement and teaching style. Researchers express the hope that teaching style and methodology may correlate strongly with pupil growth in other than the cognitive dimension (e.g., the affective domain). However, reliable techniques and instruments are scarce. Consequently, it seems reasonable to suggest that a considerable proportion of the time and energy of educational researchers should be spent in developing analytical tools. In the area

of science teaching, substantial activity is currently underway (including our own research programme) in developing instruments in the affective, psychomotor and other domains. Of specific interest are science process instruments and methods of analyzing physical as well as verbal actions of pupils and teachers.

Several other criticisms can be projected of the research design and its execution. However, in our opinion, these are of minor importance in comparison with the question of the formulation of the problem in relation to the data collected.

Eccles' Study as Classroom Interaction Analysis

Implicit in Eccles' discussion is the idea of "teacher effectiveness". For example, it might be inferred that a teacher with a high level of knowledge of science is a more effective teacher of science. Or it might be inferred that more effective teachers develop the skills and attitudes of inquiry better in their pupils, use more audio-visual aids, and incorporate demonstrations and experimentation more often in their lessons. Research has not led to reliable criteria for teaching effectiveness. Many educators now regard the question of effectiveness to be in the realm of value-judgement, hence outside the domain of research. Others propose or imply an operational approach: "effective teaching is what effective teachers do".

A current important focus in educational research is in describing "teaching as it is". Eccles' study rightfully belongs in this category. Shorn of the "knowledge of science" parameter, Eccles describes some of the behaviour of teachers and pupils in ten grade six classrooms in the Calgary school system.

In re-directing the purpose of the investigation a number of basic weaknesses must be noted. The first is in the sampling procedure. We do not know if the ten teachers selected are representative of the total group. A second, and perhaps, major weakness in Eccles' work as an analysis of teaching is that no formal code or classification was developed for the behaviour observed. Fortunately, several different inventories of teaching activities are reported in the literature, one or more of which might be adapted to Eccles audiotaped and written data.[3,4,5,6] In paying attention to some of the unique aspects of science teaching (e.g., use of demonstrations and individual experimentation), Eccles may have the necessary information for modifying one of these inventories into a more useful instrument for analysing science teaching. In accordance with the definition of the structure of science presented earlier, the inclusion of analysis for science processes and attitudes might also be possible.

It is interesting to delineate the overall teaching style of the ten

teachers in Eccles' study. Ignoring any reference to high or low knowledge of science, the following description emerges from the published report:[2]

There were significant differences among teachers in regard to both teacher and pupil talk. Spontaneous teacher verbal output ranged from 38 per cent of the observed time for one of the teachers to a high of 88 per cent.* The total number of pupil comments ranged from 52 for the lowest teacher to 194 for the highest in 80 minutes of lessons observed.** Hence, "the general teaching style observed in this study is not one in which student questions play a very important part".

Most of the pupil comments "represent student participation in what might be called a standard teaching process of eliciting and reinforcing correct responses". To what extent was discovery learning promoted? Eccles answers as follows: "Good pupil questions, attention to thought processes, hypothesizing, making observations, and drawing conclusions are the raw material of an approach to science that involves the processes of inquiry. But these elements must be structured if process is to emerge. In only a few lessons, in the classrooms of the two teachers . . . making good use of demonstrations, did some such structure or pattern emerge and this not consistently or for long periods of time. For all the other teachers these comments were not central to the structure of the lesson".

Teaching aids were used too infrequently, and no teacher emerges as dedicated to their use. Time allowed for use of books for reference during the lesson ranged from zero per cent for five teachers to a high of 29 per cent. No true experimental work was observed. Demonstration of real or three dimensional objects as part of the lesson ranged from zero per cent for three teachers to a high of 33 per cent. In the case of two teachers "the children were not just shown objects, they watched demonstrations and discussed what they observed".

Conclusion

Obviously, rigorous descriptions of what goes on in classrooms will be of considerable value in developing a theory of instruction, and in determining the relationship between teaching and learning. For the practical-minded, the classroom interaction analysis technique provides a means for continuous assessment of new science programmes, preservice and inservice training, and the independent efforts of teachers

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*The average time spent by the ten teachers on spontaneous talk was 85 per cent. If to this is added the limited pupil-talk, agreement is reached with Flanders' rule of two-thirds for toal verbal output in the classroom.[3]

**More definitive information is given by Eccles on pupil-talk, although not at the level of discrimination obtained with Amidon's instrument.[11]

to improve their classroom behaviour. Many components, besides competence in subject matter, are of importance in the teaching act (e.g., personality, enthusiasm for teaching, ability to organize and simplify content). Analysis of teaching may lead to a better understanding of the functions of these components—both in isolation and interplay.

The diversity of approaches to studying the classroom in action is very heartening. Some of these have resulted from the limitations and one-sidedness of earlier approaches. In this area, striking out along new pathways is of greater value than is replication. Hopefully, an intensive effort in description and classification of the classroom operations will ultimately have the same profound effect in education as similar efforts have had in biology.

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This article reports a study of four groups of senior high school students who were assigned varying degrees of freedom of choice in the selection of two components of the art product—subject matter and medium. Findings indicated that there were significant differences in the art products in six out of eight judged criteria, the differences favouring the group assigned the least amount of freedom of choice.

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Imposed Controls in Subject Matter and Art Media Choice

Introduction

The combined practices of encouraging students to employ a wide variety of media, and of presenting them with an extensive choice of subject matter from which to develop a creative art product, have been much in evidence in art classroom procedures in recent years. The principle under-lying these practices appears to be founded on a desire to cultivate within the mind of the student the idea of the almost limitless scope for exploration potentially derivable through art experiences. Graduates of institutions such as the Bauhaus and its expatriate offspring the Chicago Institute of Design, many of whom have directed the course taken by art education since the 1930s, have pursued the ideal of variety with proselytising zeal. Their influence has been realized by educators such as Laura Chapman, who noted of an art programme that she developed as a beginning teacher:

> The plan I presented was centred on the notion that children ought to use many and unusual materials. Almost by chance, it seems I was confronted with the fact that my conception about what *children ought* to do was based on some knowledge that artists in the Dada and Bauhaus movements had sanctioned using many new materials for artistic ends. . . . Later I was able to see that my desire for choice among media in my studio grew out of the warmed over Bauhaus tradition fostered in the college art courses I had taken.[1]

But the history of art contains numerous instances in which the artist has voluntarily chosen to exploit one particular technique or has confined himself to the exploration of *one* subject matter area for long periods of time. One is reminded of Matisse's succession of interior studies; or of the later works of Frans Hals, which demonstrate vividly a striving for maximum effect within severe self-imposed limitations. There appears to be in both these cases a willingness to relinquish variety in favour of a more austere but nonetheless rewarding *modus operandi.* It is presumably the legacy of what may be termed a rigorus approach to problem-solving in art that has led contemporary educators such as Manuel Barkan to write, "It is a hindrance if children collect knowledge through haphazard experiences with many different media before settling down to the serious business of behaving like artists."[2]

When these two attitudes, one directed towards variety in experiences and the other towards experiences in depth, are translated into classroom practice, the art programme is likely to be conducted, at one extreme, by combining complete freedom of choice with a minimum of formal instruction, and at the other, by instruction along rigid lines allowing little or no choice in subject matter or in media.

This study investigated the problem of how progress is maintained or improved in situations in which freedom of choice on the part of the student in his selection of subject matter and media has been deliberately controlled. The objective of such a procedure was to provide a pointer for the possible evolution of a programme capable of assisting students to develop in art without either inhibiting them by the imposition of too many restrictions or leaving them to flounder by a reluctance to set appropriate project limits.

Method

Population. Sixty-three students, comprising four classes on an elective Art programme in a composite high school, were assigned the following treatments over a two week period: Group I was restricted to working with one arrangement of subject matter and one medium; Group II had a range of subject matter to choose from but only one medium with which to work; Group III was restricted to one arrangement of subject matter but could employ a variety of media; and Group IV had a range of both subject matter and media from which to choose.

Materials. Still life arrangements using natural objects such as tree-roots, sea-shells and stones were employed by all four groups for Lessons One and Ten. Drawings produced during these lessons provided the material for pre-test and post-test evaluation. For all ten lessons the restricted subject matter groups (Groups I and III) employed a still life consisting of one rock and one branch. Unrestricted subject matter groups (Groups II and IV) were allowed to draw any one of four still lifes on the pre-test and post-test assignment, and for the interim lessons

were given assignments which were structured around various aspects of the theme "Nature", and which did not employ any of the still life material as a referent. The media employed in the case of the unrestricted media groups (Groups III and IV) were pencil, charcoal, india ink, conté, and black tempera paint. Restricted media groups (Groups I and II) were restricted to the use of charcoal. Slides and dry mounted photographs were used extensively as motivational material for the interim lessons. In the case of Lessons One and Ten, however, no motivation, advice or direction was given; students were simply asked to develop a drawing in a style and manner which they considered to be appropriate to the subject.

Procedure. Lessons Two through Nine were, in the case of all four groups, so structured as to concentrate on eight variables in the art work. These variables were (1) Variety within shapes (2) Connectedness and organizational unity (3) Rearrangement (4) Imagination—drama (5) Imagination—exaggeration (6) Use of texture (7) Graduation of values and (8) Variety between shapes. These provided criteria for the evaluation of individual progress and, ensured a common instructional focus.

In addition all participating students were asked to complete two identical questionnaires in the course of the two week period of instruction, one during the first and one during the second week. The questions, designed by the reseacher, were a self-evaluative nature, enquiring into the reactions of the students to the materials presented by the instructor, the progress they felt they were making, and so on. By this means it was hoped to gain insight into the group reaction pattern so that certain conjectures might be made about the relative merits and disadvantages of each treatment which could, in turn, corrobarate or have relevance to the main findings of the study.

Evaluating the Data

The eight criterion variables noted earlier as having formed the foci of instruction were selected partly because of their previous identification by researchers as being typical of a recognizable approach to art problem solving. Some years ago, the results of an examination of drawings and the students who produced them led Robert Burkhart[3] to suggest the existence of two personality patterns which he felt were readily distinguishable by the approach taken by the individual to an art problem. These two approaches were categorized as "Spontaneous" and "Deliberate" and, may be broadly defined as an emotional, holistic approach and a controlled, non-involved approach, respectively. The identification of either of those two "strategies", as they were termed, was presumed on the extent to which certain variables associated with the particular strategy appeared in the art work.

Gloria Bernheim[4] more recently re-divided these strategies into three "domains": Spontaneous, Divergent and Formal. The eight variables selected for emphasis allowed for the possibility of students exhibiting patterns characteristic of any one of these three "domains".

A score sheet was drawn up for use by six expert art judges, comprising two associate professors in Fine Arts, one assistant professor in Art Education, and two graduate students in Art Education; all of whom were connected with The University of Alberta. The sixth member was an Art Supervisor for a Public School Board. Scores were assigned on a scale of from one to five, and judges were asked to evaluate the use made of each of the eight criterion variables in drawings obtained from pre-tests and post-tests. These drawing had previously been randomized and spread out on tables.

On completion of the judging, Pearson product-moment correlations were computed between judges' ratings on each criterion variable. The results varied considerably from one criterion to another, the lowest obtained score on any one criterion being .12 and the highest .72. It was therefore decided to accept reliability of the judges for five of the criteria: Variety within shapes; Connectedness and Organizational unity; Imagination—drama; Use of texture; and Gradation of values. Findings noted under Criterion 5: Imagination—exaggeration and Criterion 8: Vaiety between shapes can only be accepte·l with considerale reservations: while Criterion 3: Rearrangement, was rejected as being insufficiently reliable for further statistical analysis.

Findings

Mean scores obtained from judges' composite scores awarded to individual works were employed as data for a two-factor analysis of covariance, using the type of multiple regression analysis described by Bottenberg and Ward.[5]

Results showed significant differences among groups at the .01 level on Criterion 5: Imagination—exaggeration; Criterion 6: Use of texture and Criterion 7: Graduation of values. Significant differences among groups at the .05 level were recorded on Criterion 1: Variety within shapes; Criterion 4: Imagination—drama; and Criterion 8: Variety between shapes.

The most noticeable feature arising from the results was the consistency of superior achievement by Group I, the group which was restructed in both subject matter and media choice. Neither Group II (restricted in media but not in subject matter) nor Group IV (unrestricted in both media and subject matter) had any consistent advantage over the other, but both achieved at a higher level than did Group III (restricted in subject matter but not in media choice) on most of the criteria specified in this study.

TABLE I

RANKED ORDER OF GROUP ACHIEVEMENT ON EACH OF EIGHT CRITERION VARIABLES AS REVEALED THROUGH MULTIPLE REGRESION ANALYSIS OF MEAN SCORES AWARED BY JUDGES

Rank	Criterion							
	1	2	3	4	5	6	7	8
1	I	I	I	I	I	I	I	I
2	II	II	IV	II	III	II	II	IV
3	IV	III	III	IV	IV	IV	IV	II
4	III	IV	I I	III	II	III	III	III

The importance of medium as a factor in the art work is suggested by its probability level of .01 for Criterion 4: Imagination—drama and, probability levels of .02 and .001 on Criterion 6: Use of texture and, Criterion 7: Gradation of values, respectively.

It was interesting also to note the superior performance of Groups I and III on Criterion 5: Imagination—exaggeration. Since both these groups were restricted in subject matter choice, it may well have been that their performance or this criterion was the result of a need to experiment with the subject matter during the course of the lessons in a manner which the unresticted subject matter groups found either unnecessary or unprofitable.

Limitations, Implications and Recommendations for Art Education

A study of this nature is essentially limited both in the circumstances under which it is undertaken and *ipso facto* in the conclusions which may ligitimately be drawn from it. The fact that a sample from only one school was exposed to the programme, combined with the time restriction imposed upon lesson lengths and on the duration of the experimental period itself, must lead the reader to an awareness that this was a tentative reconnaissance in art education rather than an attempt to establish a bridgehead for a decisive and incontrovertible statement of desirable policy. Nevertheless various surveys conducted within the province of Alberta[6] in recent years have revealed the inadequacies of art training insofar as many teachers are concerned both while they are in attendance at university and subsequently when they either seek or are given a programme of art to teach in the schools. These same teachers in the course of the school year often attempt to remedy deficiencies in training by offering innumerable projects culled from periodicals in the hope that students will find something which will occupy their attention.

One of the things which the present study has indicated is that such an approach is neither necessary nor desirable. The position of Group I, a group restricted both in media and subject matter choice, bears this out. Its performance as revealed through statistical analysis and, the responses made by its members in the questionnaires, both seems to

indicate that the most reliable progress by a group is rather to be made gradually through thorough investigation of one limited area at a time. Similarly, while the notion of exposure to a variety of media is in principle desirable, what gives the medium significance is the degree of mastery which the artist has over it. It is not enough to provide the media; concentration on their particular qualities is necessary in order that they may be used to advantage. The comparative inability of Group III, (restricted in subject matter but not in media choice), to deal with the same problems as those confronting Group I seems by statistical inference to have been the result of inadequate control of the media. These impressions were reinforced for the researchers by a visual inspection of all the drawings; the tentative handling of media by non-restricted groups was visibly contrastable with the comparative confidence shown by the restricted groups.

Some passing comment may also justifiably be made in this context regarding the apportionment of art budgets. Instead of the money being spent on a wide variety of materials of limited applicability, a proportion of it might with advantage be given over to providing motivational material, particularly slides. The slide projector played a vital role in revealing new methods towards the solution of visual problems in the course of this study, allowing the presentation of material which it would be impossible to introduce in its original form in the classroom.

The claim for the adoption of one of the experimental procedures as an unvarying pointer to success would of course be totally unrealistic. Nevertheless some comment is called for regarding the limitations of the type of programme followed by the unrestricted subject matter groups, Groups II and IV. Many Art classes are made up of individuals whose backgrounds in art vary considerably, depending on the nature and frequency of the art offerings in junior high school. A programme which attempts the production of art works through a revelation of concept presupposes a certain sophistication in the students' backgrounds which may well not have been given opportunity to develop. On the strength of certain of the information collected in the course of this exepriment, the use of definite and visible material through which concepts may be channelled might prove initially advantageous.

The entire field of objective evaluation of art products is one which raises its own crop of problems and ambiguities. It would seem that if one is a teacher of art one should be aware of what one is teaching towards and one should be capable of assessing the degree to which these aims have been met. The validity of evaluative instruments of the type used in this study is potentially of considerable importance to beginning teachers of art for the provision of a series of score-cards covering the qualities or characteristics which are felt to be desirable in student work, together with a rationale for the scale employed, would

provide a much more logical and consistent yardstick for evaluation than the largely idiosyncratic measures sometimes employed by instructors.

There are therefore numerous dimensions which experimental studies of this nature may develop. Further research is required with programmes similar to that employed in this study, but with variations in the time factor to ascertain the optimum ratio of time/creative production.

More work needs to be done on the usefulness of "cluster" projects incorporating aesthetic, historical, and studio activities in the development of one them, such as "Colour as the revelation of expression". What practical difficulties do these activities pose when put into practice in the classroom?

A whole world of research is also open for exploration in the assessment of the validity of objective evaluative criteria. The question of how to increase reliability of judges' scores so that higher intercorrelations are achieved, without at the same time biasing the judges to evaluate according to the subjective perceptions of the researcher, is an intriguing one to which at the moment no answer is forthcoming. Experiments undertaken with an evaluative instrument, to be used by expert judges, then by intelligent laymen, so that the degree of consistency between the two groups' judgemnts may be assessed and conclusions drawn thereby on the objectivity of the instrument, should provide rich material for analysis.

One should however, never lose sight of the role of the subjective dimension in the creation of an art product. A student with a high score on the type of instrument described above is not necessarily a better artists because he has exhibited definite progress in the utilization and realization of specific factors which contribute to the total effect of the art work. In the words of Henri Matisse:

> To create is to express what we have within ourselves. Every genuine creative effort comes from within. We have also to nourish our feeling and, we can do so only with materials derived from the world about us. This is the process whereby the artist incorporates and gradually assimilates the external world within himself, until the object of his drawing has become like a part of his being, until he has it within him and can project it on to the canvas as his own creation.[7]

The role of the teacher covers both the nourishment of feeling and the making aware to the student of the materials on which he may draw. What this study demonstrated is that in the revelation of material there is no simple equation between variety of material and variety of expression, and that restriction need not be concomitant with deprivation.

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The relationships between the socio-economic levels of the school attendance areas in one school district and some variables related to the principal, school and teaching staff are presented. Certain observed imbalances suggest careful scrutiny of building, programme and staffing practices in large school systems.

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Socio-Economic Level and Some School Characteristics

Introduction

Recent literature has dealt extensively with problems related to equalization of educational opportunity for children of different cultural, ethnic or socio-economic backgrounds. The focus has often been upon differences within a particular school or classroom (a micro approach), or upon differences in educational quality or opportunity between geographically separate areas (a macro approach).

Thayer has pointed out the significance of the relationship between education and socio-economic status:

> . . . findings suggests that socio-economic status is a determining factor in deciding whether or not young people are to enjoy equal educational opportunities, a factor which the school is none too successful in counteracting.[1]

Another issue has been raised by Sibley; pupils of lower intelligence, and pupils whose parents have relatively low socio-economic status, are continually eliminated as the progression is made to higher educational levels.[2] The failure of the lower-status children was once attributed to low intelligence, whereas it now appears that other factors such as teachers' attitudes, home environment, school conditions and availability of finance, are involved.

The importance of the effect of different value systems is stressed by Hyman who showed that the wealthy and prosperous, whose children proceed further with education, place more value on the need for

education than do people in the middle class, who in turn see more value than does the lower class.[3] This finding applied to both men and women in the age groups of 21-39 years and over 40 years.

Social mobility has also received considerable attention. For example, in *Education, Economy and Society,* Rogoff has stated that American, British and Western European studies have shown that the amount of formal schooling obtained by children is associated with the variance in attained social class of children who started life in the same social class.[4] Other articles in this publication give an indication of the ramifications of the research into the relationships between education and social class. Becker concludes that "the schools, then, function importantly in the operation of the system of status and social class of the societies in which they exist."[5]

In this paper, the relationship between socio-economic and educational factors are investigated within a school system in Western Canada. Certain differences between educational variables and the socio-economic level of the school attendance area are examined, and some attention is paid to the implications for educational administrators aiming at the provision of equal opportunity for all pupils.

I. Background of the Study

The findings reported in this article are by-products of a larger study which was concerned with the determination of relationships between measures of innovativeness and forty-five independent variables related to the schools, principals and teaching staffs.[6] Socio-economic status of the school attendance area was chosen as one of these independent variables. In this analysis, the data was reorganzied by making the socio-economic rank of the school the dependent variable rather than innovativeness. By using computer analysis, many additional or serendipity findings are now available to the researcher—it is hoped that this report will indicate the significance of this means of obtaining such additonal information and, as well, direct the attention of educational administrators to the relevant substantive findings.

In order to obtain a sufficiently large and uniform number of schools, the elementary schools of one school district were chosen for investigation. As the intention of the larger study was to focus mainly on variables related to the principal, only those elementary schools containing at least twelve classrooms were chosen in the sample. A principal in such a school had at least 70 per cent of his time free from classroom teaching—a time assessed by the reeachers as sufficient to allow classification as an administrator rather than a teacher. In addition, the principals chosen were in at least their second year of office at the particular school, and the combined elementary/junior high schools had to be essentially elementary in character.

These restrictions resulted in the selection of a sample of forty schools from a population of ninety-four elementary/junior high or elementary schools. Consequently, the sample generally contained the lager schools in the school district, and the school attendance areas tended to form a band around the city. The banding effect illustrated by the selected schools can be attributed to the concentric ring patterns of city growth with schools of the sizes required for this sample located in rings of later growth. However, a full range of socio-economic status of attendance areas was represented in the sample and therefore the results do not seem to have been materially affected by this phenomenon. The findings in this article should be interpreted in the light of this information.

Data were collected by interviews, questionnaires, and examination of school board and city records. The analysis was mainly performed by determining Pearson product-moment correlations, which were examined for significance by using two-tailed tests at the 0.01, 0.05 and 0.10 levels of significance. The information shown in Table I describes in general terms some of the variables related to the principals and schools in the sample.

TABLE I

DISTRIBUTION OF SOME VARIABLES DESCRIBING PRINCIPALS AND SCHOOLS IN THE STUDY

(N = 40)

Variable	Mean	Range
SCHOOL		
Number of classes	15.4	11- 28
Number of students	504.0	284-827
Pupil-teacher ratio	26.8	21- 31
PRINCIPAL		
Age	51.2	34- 63
Number of years of university education	5.1	1- 7
Number of years as principal	11.8	1- 22
Number of years in present position	5.1	1- 12

II. Assessment of Socio-Economic Rank

Warner used an Index of Status Characteristics (ISC) as a measure of social class and based this use partly on the assumption ". . . that economic and other prestige factors are highly and closely related with social class. . ."[7] This ISC, which is a weighted sum of the Status Characteristics of occupation, source of income, house type and dwelling area, is seen by Warner to be useable as an index of socio-economic status. Another index of class status was developed by Hollingshead by weighting occupation, amount of education, and area of residence.[8] Kahl and Davis determined that the best measureable predictors of class status were, in order, occupation, education, source of income, dwelling area, house type, and amount of income.[9]

In order to rank the socio-economic levels of the school attendance

areas, it was necessary to resort to gross measures because the more highly recommended indicators of occupation, education and income, for which means would have been calculated, could not be obtained for the large area involved. Instead, three individual assessments were obtained: (1) mean value of houses sold, and the independent opinions of (2) a school planner, and (3) a city planner. These three assessments were also combined into an average socio-economic ranking.

The mean value of houses sold in each school attendance area was obtained by placing an overlay of the attendance area upon a map of the city assessment areas, and proportioning the average house values in the relatively few cases where the boundaries were not coterminous. It was relaized that factors such as new housing developments may have affected the mean value of houses in some of the attendance areas. However, an examination of the obtained information indicated that this effect had not altered the socio-economic ranking given to these areas. The range of the mean values of houses sold since 1963 was from $9,189 to $24,439.

The two planners were asked to place the forty schools in nine categories, but no restriction was imposed on the number of schools which could be placed in any category—this was left to the discretion of each person. Nevertheless, approximately normal distributions were obtained. The distribution of the mean values of houses sold in each attendance area was approximately normalized by placing them in a nine-category distribution. The correlation coefficients obtained between the individual and combined assessment were all significant at the 0.005 level, (Table II).

TABLE II

INTERCORRELATION MATRIX OF VARIOUS ASSESSMENTS OF SOCIO-ECONOMIC STATUS OF ATTENDANCE AREAS OF SCHOOLS IN SAMPLE

(N = 40)

Socio-economic assessment	1	2	3	4
1. House value	1.000	0.760	0.595	0.856
2. School planner		1.000	0.671	0.894
3. City planner			1.000	0.840
4. Combined				1.000

The high degree of association between the socio-economic ranks assigned independently by the planners and developed from the average value of homes sold indicates that the socio-economic status of school attendance areas was relatively unambiguous. Further, there is no apparent reason for school principals and administrators generally to be any less aware of this phenomena than were the planners. Planners were used in the ranking process because it was believed that they would be more aware of the whole district, whereas school officials are more

likely to be familiar with the socio-economic phenomena in only that portion of the district in which they had been active.

Table II was interpreted to mean that socio-economic differentiation did exist in this district, and further, that school attendance areas could be classified in terms of this socio-economic differentiation.

III. Interpretation of the Findings

The derived correlation coefficients between the socio-economic level of the school attendance area and the independent variables are shown in Table III. All variables which developed statistically significant correlations with the socio-economic rank of the attendance area are included. For the sake of completeness, as well as because of their special import, the correlation coefficients with the three Indices of Innovativeness are also reported. Considerable consistency can be observed between the findings for each of the four methods of assessment of socio-economic status.

TABLE III

CORRELATION COEFFICIENTS BETWEEN MEASURES OF SOCIO-ECONOMIC LEVELS OF SCHOOL ATTENDANCE AREAS AND CERTAIN SCHOOL, PRINCIPAL AND TEACHER VARIABLES[1]

N	Variable	Measure of socio-economic level of school attendance area			
		Value of houses sold	Judge 1	Judge 2	Combined
	PRINCIPAL				
40	Years as principal	0.247	0.329[b]	0.109	0.280[c]
40	Level university education	0.408[a]	0.557[a]	0.231	0.448[a]
40	Hours teaching per week	-0.311[c]	-0.414[a]	-0.441[a]	-0.431[a]
40	Salary	0.496[b]	0.597[a]	0.436[a]	0.555[a]
	SCHOOL				
40	Number of classrooms	0.251	0.327[b]	0.264[b]	0.352[b]
40	Number of pupils	0.344[b]	0.388[b]	0.315[b]	0.421[a]
40	Adopted of French[2]	0.347[b]	0.524[a]	0.338[b]	0.489[a]
40	Percentage adoption of French	0.398[b]	0.529[a]	0.476[a]	0.525[a]
40	I_1 (adopation)	0.168	0.187	0.253	0.230
40	I_2 (extent)	0.058	–0.015	0.120	0.054
23	I_3 (time)	0.235	0.155	0.402[c]	0.297
	TEACHING STAFF				
40	Average level of training	0.302[c]	0.450[a]	0.292[c]	0.428[a]
40	Average competence rating by principal	0.158	0.245	0.183	0.251

[1]Coefficients needed for significance for two-tailed tests are as follows:

Significance level	N = 40	N = 23
0.01[a]	0.403	0.526
0.05[b]	0.312	0.413
0.10[c]	0.264	0.352

[2]Scored by giving 2 for adoption, 1 for non-adoption.

Variables Related to the Principal

Principals with higher levels of university education were associated with schools in higher socio-economic areas. These men tended to have

had more experience as principals than did those in poorer areas, and to be located in larger schools—consequently they also received higher salaries. The larger school size also meant that the principals in the higher socio-economic attendance area schools taught fewer hours per week.

A picture therefore emerges of the more experienced, more highly trained and more highly paid principals, teaching fewer hours per week, occupying schools in the higher socio-economic areas of the school system.

Variables Related to the School

(i) *Size of School* Significant positive correlations (average $p < 0.05$) were obtained between the socio-economic ranks and the numbers of pupils and the numbers of classrooms. This indicates that the larger schools tended to have been built in the higher socio-economic areas. Because larger schools, at least in some areas, tend to have better facilites, such as libraries, auditoria and gymnasia, as well as more equipment, this aspect possibly deserves more careful examination than has previously been given.

(ii) *Teaching of French* In this school district, Oral French was taught in some classes in Grade 5 and 6. Certain factors were apparently operative in the adoption process, especially the opinion of the principal as to its value ,the availability of teachers, and parental pressure upon the principal. Oral French was more often adopted in schools in the higher socio-economic areas ($p < 0.05$). Adoption in some cases meant that French may have been taught in only one class, whereas in others it meant that all classes in Grades 5 and 6 studied French. In this regard, the percentage adoption of French (i.e., the ratio of the number of Grade 5 and 6 classes taking French as compared with the total number of Grade 5 and 6 classes) was also significantly greater in the higher socio-economic areas ($p < 0.05$).

If parental pressure is seen as one of the explanatory factors for these phenomena, then some agreement with findings reported by Downey is apparent. He reports studies which show that the higher socio-economic classes favour cultural and intellectual pursuits in school more than do the lower socio-economic classes, who see vocational education as a more suitable goal for the schools.[10] Although Downey's findings were specifically related to the secondary school, downward projection into the upper elementary grades would appear to be appropriate.

It should be reported that the other four innovations which were studied did not show differences associated with differing socio-economic areas in respect to either adoption, non-adoption or extent of adoption within the school. These other innovations were departmentalization,

regular use of central office consultants, the holding of parent-teacher interviews from 3-5 p.m. and the regular classroom use of television.

(iii) *Indices of Innovativeness* Three separate but related Indices of Innovativeness were developed to measure various aspects of innovativeness. The Index I_1 measured the number of innovations adopted by the school. In order to measure the extent to which the innovations were adopted within each school, the Index I_2 was developed by normalizing the sum of the extent of adoption scores for each innovation. Index I_3 was developed by normalizing the sum of the number of years since adoption of the three innovations, namely, use of consultants, use of parent interviews and use of educational television, which had been introduced after a sufficiently large subsample (N=23) of the principals were in their present positions.

The results in Table III show that I_2 does not appear to be associated significantly ($p > 0.10$) with the socio-economic level of the school. However, Indices I_1 and I_3 show positive relationships which generally approach the 0.10 significance level.

Interpretation of these findings is difficult. In planning and discussing the study, the researchers were careful to avoid placing or indicating any value of "goodness" on innovativeness *per se.* and the chosen innovations covered five different aspects of education, with each innovation having protagonists and critics. However, the current concern with innovativeness may have led the respondents to attribute a quality of "goodness" to the adoption of new practices. The results do point, nevertheless, to the fact that the higher socio-economic schools generally innovate earlier and more widely than do schools in lower socio-economic areas.

Variables Related to the Teaching Staff

Schools in the higher socio-economic areas appear to possess teachers who are more highly trained ($p < 0.05$) than are teachers in the schools in lower areas. Although the average competence rating given by the principal for his staff did not correlate significantly at the 0.10 level, a positive trend is noticeable. These results are in accord with those reported by Becker,[11] who says that teachers see schools as dissimilar and tend to move away from schools handling children of subordinate groups:

> More generally, it is probably true that, whatver the qualities a school system wishes to reward in its teachers, those qualities can be effectively rewarded only by assignment to the more desired schools, so that disadvantaged groups, who require the most skilled and experienced teaching, get the opposite and something less than an equal chance to an education.[12]

This is to say, schools, in trying to solve problems such as recruitment and distribution of teachers operate so that subordinate groups do not get

their fair share of educational opportunity and consequently lose some opportunity for social mobility. Care should be taken when interpreting these results to understand that there is no implication that these conditions occur by design. School administrators do not intend these results. Rather, the findings of what can be construed as relative disadvantage in schools serving lower socio-economic areas appears to result from a complex interaction between factors.

IV. Expectation for Innovativeness

When claiming the association of socio-economic status of attendance area served and selected variables describing the school, the principal and the teachers, there was one set of data that could not be said to fall into any of the three categories. As a part of the larger study, selected central office personnel were asked to rank the schools under study with regard to innovativeness. That is to say, the personnel were asked to make explicit the expectations they held with regard to each schools' innovativeness. Sixty-six per cent of the raters submitted ranks that correlated significantly ($p < 0.05$) with the socio-economic ranking of the attendance area. In other words, another correlate of socio-economic status was the expectation held by ceneral office personnel that schools serving higher status areas would be more innovative.

If it can be argued that schools like people tend to perform in accord with the expectations held for them, then schools in low status areas would be expected to continue present practices with less adoption of new practices. Further, if the key to improvement in education is located in the adoption of new practices, then it can be argued that schools serving relatively lower socio-economic areas are not expected to improve as rapidly as others. Again it must be emphasized that these findings cannot be interpreted to mean that administrators have adopted a deliberate pattern of discrimination against schools in lower socio-economic areas; there is no evidence of such intent. Rather if discrimination does exist it is an unanticipated consequence of present practices in education.

V. Implications for Educational Administration

With the current emphasis on equalization of educational opportunity the educational administrator must become more and more aware of the unanticipated consequences of current practice. It may well be that factors associated with current school district procedures defeat the goal of equalizing opportunity. To the extent that other school districts and jurisdictions are similar to that used as a basis for this study it can be argued that this is in fact the case.

If there is any relationship between teacher training, teacher experience, and the quality of the teaching-learning interaction, then school

administrators may well wish to examine anew the basis of teacher transfer. This is not to imply that teacher requests for transfer should be ignored, but rather to indicate that many factors should be considered. If in fact, teacher transfers are already initiated by the central office then the central office might well concentrate on maintaining an appropriate "mix" of training and experience on each teaching staff. This is not to suggest that the teacher training and experience "mix" should be the same for each school, but rather that it should be tailored to the specific school so that the school will be best able to serve the clients assigned to it.

There are implications in the study that promotion for the principal means moving to a larger school. If this is the case and if the larger schools do serve higher socio-economic areas, then the practice of assigning better principals (hopefully those worthy of promotion) to larger schools tends to provide the lower socio-economic schools with the least able administrators. It might be worthwhile to consider promotion plans for principals that would encourage able adminstrators to serve in the school that allows the fullest utilization of their abilities. This is not necessarily one of the larger schools nor schools in higher socio-economic areas. While several suggestions for practice occur in this regard, it would seem that the only effective solutions will be those developed by the principals in question.

It can be argued that the schools with the greatest need to be innovative are those serving the lower socio-economic areas. In this sense it may be necessary to provide these schools with greater amounts of the elements that correlate with innovativeness. Inequality of resources may be needed to provide equality of educational opportunity. This may mean that these principals need to have more time free from teaching. They may need to be the best educated and most experienced and the teachers in these schools may need to be both the best trained and the most competent.

It would seem apparent that socio-economic factors and areas within a community are associated with what can be interpreted as an inequitable distrubtion in the quality of the resources available to the schools. While this has not come about by design or intent it does seem to be operative. The problems present in eleminating this inequality are many and severe and they warrant the best efforts, thought and consideration that educators can provide. The efforts of administrators should be directed toward the achievement of the distribution of educational resources which shall yield equalization of educational opportunity. Hopefully this equalization will raise all schools to the standards of the highest quality currently present in the district, province, state, or region, and that it will not lead to a regression toward mediocrity.

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This paper is intended as an outline for a theory of behaviour. No attempt has been made to describe the mechanisms or neurological correlates of behaviour, the exact roles of the determiners of responses, or the developmental dimension of learning. The explanations of causation, determination, and control of behaviour are intended both as guides of the classification and global interpretation of human learning and responding, and as illustrations of psychological principles developed from and consistent with basic philosophical notions.

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A Theory of Behaviour (or As You Like It)

A learning theory, if viewed as a rather generic conceptualization of total human behaviour, must not only account for various phenomena that can be observed readily (or not so readily discovered), but must, if it is to be intelligible, be based on metaphysical and epistemological conceptions from which the theory is derived and with which, consequently, it must be consistent. Even as it is impossible to describe how man learns without stating (or implying) an epistemological position, so it is impossible, or at least illogical, to derive an epistemological position without knowing or assuming the nature of reality. That is, insofar as a learning theory should deal with *what* is or can be learned as well as with *how* the what of learning becomes learned, it is based on at least some aspects of philosophical theory. Perhaps even more central to a learning theory is the question, "What is the nature of man?" again, a metaphysical question.

In addition, a learning theory must take into account what causes behaviour, what determines it and, what controls it. Eight principles will be described in this paper to account for a metaphysical position, an epistemological position, and the causation, determination, and control of behaviour.

Metaphysics

"Je pense, donc je suis!" If we are to accept Descartes' intuitive proof of the existence of man, then we can admit that the essence of

man lies in his ability to think. Having admitted his existence and his essence, we have not determined his *raison-d'etre*—nor is it directly pertinent to do so. It suffices to accept that if we say that man exists as a rational being, his reason being the proof of his existence, we have done nothing but utter a tautology, but the tautology does not alter the proof since it is intuitive to begin with. *Ergo*, the first principle of the theory is:

(1) Man exists as a rational, sentient organism, capable, because he is sentient, of apprehending the environmental forms of which he is but inline, and capable, because he is rational, of ordering and interpreting, within limits the qualities and quantities of the environmental mass and of the central substance of his being within the inline.

Even as knowledge of our existence is its proof, so knowledge of the environment is, at the same time, proof of the existence of the environment, and proof of the sentient qualities of man. An individual is referred to as the inline of his environment because, viewed as a global existent, this environment may easily be seen as outlining at least the physical aspects of man, whereby the thing which man is becomes the inline of this space. The second metaphysical principle is, then, that:

(2) Reality, for man, is that which he is capable of sensing.

This does not deny that there may be a greater reality than that of which we are aware, or that the dimensional qualitative, and quantitative representations we make of reality may be non-veridical due to limiations of our sentient and/or rational capabilities. It can readily be seen, however, that a parsimonious learning theory need be concerned only with what man is capable of sensing rather than with what might actually exist.

Epistemology

The central questions of epistemology can be answered by direct reference to the first two principles.

(3) Knowledge is the substance and the product of thought.

It is the substance of though inasmuch as representations of environmental forms constitute the raw material of intellectual activity. It is the product of thought insofar as intellectual activity results in cognitions. Obviously knowledge, because it is a product of individual sentient and rational activity, cannot be considered an absolute or a set of absolutes if we allow that these activities may vary from person to person. That this is the case is self-evident. It does not deny, however, that truth may be "timeless and everywhere the same" (Hutchins), but it does assert that we do not know this *truth* if it exists as an absolute.

The fourth principle is implicit in the third:

(4) Knowledge is procured by man through his sentient and his rational capabilities.

A distinction is intended here between perceptual and conceptual activity. The former is taken to signify only the activity of the sentient

aspects of man (including internal and proprioceptive sensation)—this activity producing that knowledge which is the substance of thought. The latter is the process which, using the product of sentient activity, produces a relatively more abstract form of knowledge.

The foregoing philosophical principles are compatible with a realist position in that reality is said to exist apart from man regardless of his activity with respect to it; an existentialist position insofar as they assert that man only knows things to the extent that he acts upon them, and an idealist position inasmuch as man can deal with the environment only in terms of his knowledge of it, but perhaps not in terms of the environment *per se*.

Purpose in Man

Before a serious discussion of behaviour in man can be undertaken, a principle must be postulated in order to account for the fact that there is learning and that there is behaviour. It is not sufficient to show what mechanisms man possesses for behaviour or how these mechanisms work, but one must also show *why* they work. There are a number of explanations. One can say that a machine, given fuel, will work—we must still admit, however, that there must be an initial spark or source of power. Alternatively, it can be maintained that a machine will work if its maker *wills* it to work. Man will perform if, and because, his maker wills him to do so. Or, again, a machine may work because it has an underlying purpose apart from its maker. Man is a purposive being, the nature of that purpose determining not only why he will function, but, to a large extent, how he will function. The third alternative is the one that will be accepted here. The mechanical predictability of functioning of a machine, given certain conditions, is not easily reconciled with the erratic performance of man under diverse sets of conditions. Nor is it profitable to lose oneself in speculations regarding the intentions of an alleged Prime Mover.

There remains only to describe the nature of the purposive element in man. For this, it is not necessary to go beyond that which can be sensed and interpreted rationally, nor would doing so be compatible with the position adopted thus far in this paper.

> (5) Man is a purposive being insofar as his global actions are directed largely through the exercise of *will* toward an adaptation which is defined in part by survival and in part by pleasure-seeking.

It will be noted that principle (5) invokes little more than logical deductions from phylogenetic and ontogenetic developmental changes and a generic view of behaviour-involving-choice as pleasure-seeking provided that survival and, more generally, adaptation are not too obviously jeopardized. This does not deny that some behaviour may not involve choice but may be purely involuntary. Such would be behaviour that is predetermined by conditioning or by reflex. Will is included in

a description of the nature of man inasmuch as it appears evident that he can and does control his actions consciously, although largely in accordance with what he thinks will promote survival and/or pleasure.

The full import of this principle is made evident by its role in the subsequent development of this outline for a theory.

Behaviour

Causes of Behaviour—It is both inevitable and fruitful to view behaviour as a set of responses. Then behaviour *per se* can be described in terms of these responses even as further responses (future behaviour) can be predicted in part on the basis of knowledge of past and present habits of responding under more or less precisely defined circumstances. The point, however, is that these circumstances must be defined and their relationship to the response domain must be examined.

> (6) Causes of behaviour (overt or covert responding) may be said to lie primarily in antecedent and present circumstances (stimuli) which may be observable or which may be merely implied by the response.

This sixth principle is intended to verbalize a position that can easily be viewed in statements involving use of the symbolism of propositional logic. Where behaviour is taken to be a set of responses (R), casual agents are sets of stimuli (S), and the symbols $\supset$, v and, . indicate implication, disjunction and conjunction respectively,

$$\text{(i)}\ S_1 \supset R_1 \vee R_3 \vee R_j \vee \phi$$

A set of stimuli implies any of a set of responses or no response at all (ϕ). The truth of this statement is obvious: a cake may be eaten, thrown away *et cetera,* or it may be ignored.

$$\text{(ii)}\ S_2 \supset R_1 \vee R_2 \vee R_j \vee \phi$$

A length of garlic sausage may also be eaten, thrown away, or ignored. In short,

$$\text{(iii)}\ S_1 \vee S_2 \vee S_j \supset R_1 \vee R_2 \vee R_j \vee \phi$$

It should be noted, first, that one set of circumstances need not necessarily lead merely to one of a set of responses but may, and does in fact, often lead to responses involving the conjunction of alternatives in the set, in which case it is not amiss to think of the first response occurring as becoming a stimulus for the second response. The integration aspects of the Osgoodian model may be cited in support of this notion. Secondly, it is to be noted that the null symbol (ϕ) indicates no response in the sense that the stimuli are not attended to—not in the sense that the response is not observable.

Thirdly, principle (6) emphasizes that both stimuli and responses need not be observable. In other words, a stimulus may be cortically induced, proprioceptive, or interoceptive, while the response may in-

volve nothing more than perhaps a neural change, a conscious awareness, or mental activity. Any attempt to specify its nature more precisely must, of necessity, involve more speculation than fact.

$$\text{(iv) } S_j \supset [R_i \mid R_i \text{ is a conjunctive or disjunctive combination of a set of } R_j\text{'s v } \phi]$$

This final statement means that a stimulus situation, observable or otherwise, will lead to a response which may be one of a set of responses or a combination of a number of elements in this set, or that the stimulus may lead to no response whatsoever.

Determination of Behaviour—Having developed a principle to account for the fact that behaviour is caused by stimuli of various kinds ($S_j \supset R_j$ v ϕ), it is now necessary to postulate a seventh principle which will explain what it is that determines the particular response which will occur.

(7) Given the statement $S_j \supset [R_i \mid R_i$ is a conjunctive or disjunctive combination of a set of R_j's v $\emptyset]$, choice of R_i may be considered to be a function of subjectively learned payoff values associated with each alternative R, these values being in turn dependent on past reinforcement, contiguity learning, survival and pleasure consequences, and habitual modes of responding (personality traits) subjects to situational modifiers.

Principle (7) specifies what the major determinants of behaviour are, but does not attempt to explain how these determinants interact to effect choice of R_i. It is evident, at any rate, that the role of any stimulus in determining behaviour will be tempered or enhanced by this interaction. Nor is the term *determinant* as applied to the interacting elements entirely accurate. These are considered determinants only in that they are instrumental in effecting a choice of response. They cannot be thought of as limiting this choice to any one specific response if the system is to achieve any degree of internal consistency. That is, because it is postulated in principle (5) that man is free to exercise control within limits, it must be argued that prediction of behaviour is possible only to the extent that this freedom does not dictate choice of an unexpected response.

It is appropriate, at this point, to look at the limits within which behaviour must operate. It has been postulated that for any given stimulus situation which engenders some form of behaviour—the stimulus situation comprising both external and internal elements—a set of alternative responses is available. This set is limited first by the number of appropriate responses that the individual has learned; secondly, by the number of combinations made possible by the set, and finally, by the necessity that these responses be compatible in general with survival and pleasure-seeking goals. It must be admitted, however, that while it can be argued that masochistic behaviour is, in fact pleasure-seeking

behaviour provided that pleasure is defined as a subjective valuation as it properly should be, it cannot be argued that an attempt to commit suicide is compatible with a survival goal! It is because of these *individual differences* that psychological theory often claims to describe only the typical. It is for this reason also that it has been found necessary to postulate that elusive quality, will.

Control of Behaviour—If a given stimulus always lead to a specific response, then control of behaviour would rest solely in the hands of who or whatever controls stimuli. As it is, however, stimuli are controlled largely by individuals—as are responses. In order to clarify this aspect of behaviour it is necessary to speculate about the nature of sentient and rational activity.

> (8) Man organizes and groups perceptual and cognitive knowledge largely in accordance with similarities evident in stimulation from objects and events, but also in accordance with arbitrary rules and idiosyncratic personality dispositions which are highly loaded with affect.

Perceptual knowledge is taken to represent the product of sentient activity whereas cognitive knowledge is the product of intellectual organization of perceptual knowledge. That there is organization of knowledge is evident in our ability to order and serialize events and, consequently, to reduce the complexity of the environment. Why this should occur is implicit in principle (5) which specifies that behaviour will largely be determined by adaptation designed for survival and for the attainment of pleasure. How it occurs is a matter of speculation—speculation which can lend little if anything to the pragmatic value of a theory.

Principle (8) states that organization is often achieved in terms of arbitrary rules (man classifies objects in terms of the attributes that define their classes) and in terms of idiosyncratic personality dispositions (a prevailing attitude, acquired perhaps largely through learning, affects classification of people of certain races). Thus control of behaviour resides at least in part in the manner in which an individual *chooses* to interpret his environment—a matter in which he has choice only insofar as he can *willingly* alter his interpretation and response. There is also a more peripheral type of control, of which the individual is largely unaware, whereby the chaos that would result from the necessity of interpreting all sensory stimulation is guarded against. Thus perceptual knowledge is limited by the amount of input from sensory receptors and, in turn, limits cognitive knowledge.

Conclusion

This paper presents an outline for a learning theory derived from and consistent with specific philosophical ideas. The paper is premised on the assumption that a re-examination of the basic issues in psychology

may help to reduce the redundancy and triviality of much of what is done in its name. No attempt is made to develop a precise explanatory and predictive theory—indeed, it may well be that such models are impossible if, as Asimov contends, it is axiomatic that those things which are understood must be simpler than whoever or whatever understands them. Nevertheless, we may someday know more and, realize that we know more, about man than we now do—or we may finally admit that we have reached the logical limit.

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In this article the author reports a study in which the Adorno F scale was administered to 182 Canadian ninth grade students who had been divided into three achievement categories, (Failures, Mediocres, and Honours) on the basis of a provincial academic examination. A variation in the usual method of responding did not change the expected result of an inverse correspondence between achievement level and authoritarianism. Some implications concerning the relationship between this outcome and the social class level of the student were also discussed.

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Achievement and Authoritanism as Components of Socio-Cultural Factors

The California F scale, developed by Adorno *et. al.*[1] has been the stimulus for much subsequent critical analysis. The scale itself is made up of some thirty statements to which the subject is required to give one of six standard replies ranging from strong support to slight support on the positive, to slight opposition through strong opposition on the negative.[2] The degree of authoritarianism is determined by the average response made by the subject, starting with one for the response of complete disagreement to seven for complete agreement; four is scored if the individual doesn't answer the item. A high number of agreements with the statements supposedly indicates an anti-democratic personality.

According to Adorno *et. al.* the main purpose for constructing the F´scale was two-fold: (a) to measure prejudice and (b) to elicit "anti-democratic tendencies at the personality level". It was hypothesized that there are many people who have a definite psychological disposition to be prejudiced and anti-democratic. Furthermore, it was hypothesized that persons who have these dispositions are a distinct and homogenous group and therefore can be detected by a rather simple "indirect" questionnaire.

To determine the parameters of the various psychological variables that go into the makeup of an authoritarian personality was no small task. The research project that was carried out by Adorno and his

associates was extensive as is indicated by the size and complexity of the monograph produced.

In any undertaking of this size some of the assumptions and methodological considerations that are utilized soon become subject to critical analysis. Probably the most objective and thorough methodological critique of the scale was made by Hyman and Sheatley and reported in a book edited by Christie and Jahoda.[3]

Another method of aassessment of an instrument of this nature is factor analysis. Originally Adorno *et. al.* hypothesized that nine factors including conventionalism, authoritarian submission, authoritarian aggression, anti-intraception, superstition and stereotype, power and toughness, destructiveness and cynicism and projectivity and sex are component of the authoritarian personality. More recently Krug,[4] using a computer with a quartimax rotation method found that there was a general common variance of the thirty items on the F scale and also at least six other factors with significant loadings. Most of Krug's factors were similar in item composition to those of Adorno *et. al.* The most important result of this study however was the discovery of the general factors which attested to the validity of the scale.

A third type of analysis uses correlational techniques for the purpose of detecting any extraneous variables that might be measured by the scale. The method used in this type of study tests the correlation of the F scale with various other psychological and sociological factors of well-established dimensions, such as intelligence, aptitude, social class, et cetera. It is in this area that the F scale has been most subject to criticism.

The first independent study to note some of these "nuisance" correlations was reported by Gough.[5] Among other things, Gough found that the "E-F" scale[6] (E-ethnocentrism, F-implicit anti-democratic trends) correlated -.43 with intelligence (OTIS) and -.37 with social status (the home scale) for high school students.

In a correlational study, Cohen[7] cited Levinson's findings reported in the original monograph that the Stanford-Binet correlated -.48 with the F score for 104 employment service veterans. He also reported his own findings of a correlation (-.135) between the F scale and the Atlas Verbal Aptitude Test using 140 college students as subjects. The same author also tested sixty-four college students by varying the instructional set. On an initial administration of the scale the subjects were told to respond like people "Who are highly educated and intelligent". In a second administration he told the subjects to respond "as unskilled labourers of low intelligence and grammar school education". In comparing the scores of the two administrations Cohen found a significantly higher score on the latter administration. From these results Cohen

concluded that more intelligent individuals will "penetrate" the meaning of the scale and respond in the "proper" manner. Hence the instrument may permit falsification of personal values, so that its validity with more educated or intelligent subjects is questionable. Finally, Davids[8] also found a correlation of -.37 between the F scale and college grades. From these studies it may be seen that the F scale is subject to various external factors.

In the present study the F instrument was administered to 182 ninth grade students in Alberta, Canada. This testing was part of a larger study, the general purpose of which was to discover the relationship between academic achievement, socio-economic position and the value orientations held by the parents. The specific purpose of the F scale administration was to test the relationship between achievement and authoritarianism for Canadian junior high school students.

Background and method

Three groups of students were selected in the larger study; the honours, mediocres* and failures. The determination of these groups was made by the Alberta Provincial Department of Education. This bureau gives all ninth graders in the province a battery of achievement and aptitude tests for the purpose of determining the academic potential of the student in such areas as literature, science, mathematics and reading. The aggregate scores obtained on these tests are then broken down into stanines. The top two stanines are designated as the "honours" group, the bottom two as the "failures" group and the middle six as the "pass" or "mediocre" group. The larger study utilized the entire male population of failures and honours in the ninth grade of all public schools in Calgary. The mediocre group was obtained by selecting randomly 50 per cent of the students in the fifth stanine.

Unfortunately in the F scale administration, only nine of the failures were able to finish the inventory within the permitted block of released time. This was because the F scale was not given until the last part of the testing period allowed by the administration of the school. Nevertheless, a large number of the mediocres, and honours, did finish the scale (70 mediocres and 105 honours). For this reason the scores for the mediocres and the failures were collapsed into one category for purposes of statistical analysis. It was further hypothesized that the nine failures who did finish may not have been a representative sample of the failure population since they were evidentally more efficient performers on the other tests that were administered before the presentation of the F scale. It might be concluded that these nine individuals were the more effective test takers in the failure group though this factor was never validated against their school performance.

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*The Department of Education uses the term "Pass" rather than mediocre.

It should be noted that a different method of responding was used for this administration of the F scale. Instead of giving the subjects a choice of six responses, only two choices were given, i.e., "agree" or "disagree". It was hypothesized that if the subtle differences in responding that were offered by the original F scale were absent, then the more insightful person would either have to state his actual feeling or manufacture what he considered an acceptable response. In this way it was felt that it would be more difficult for the subject to rationalize his true motive in responding.

Results and Discussion

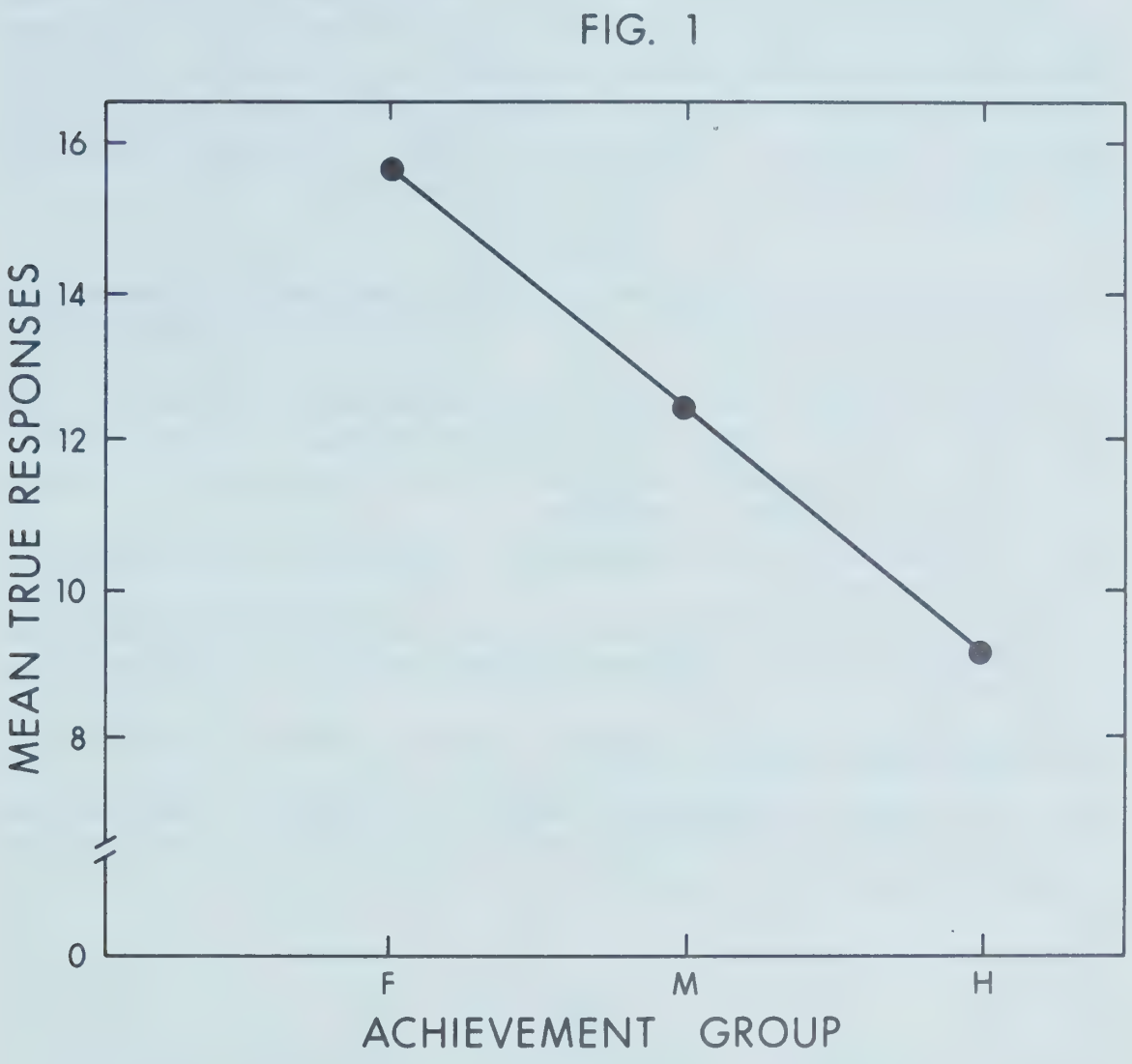
The t test performed between the two groups of failure-mediocre and honour refuted the implication that the different method of responding would dilute the inverse correlation usually found between achievement and a high score on the F scale ($t=5.87$; $p < .001$). Furthermore, though no statistical tests were performed, the failures also showed a trend in the expected direction (note; Figure I).

It would seem that Cohen's assumption that the intelligent person can penetrate the F scale and answer in an adjusted manner is feasible regardless of the number of response discriminations offered him.

Another explanation of these and other results which show an inverse correspondence between the F scale and level of education might be found in the social class factor. The original Adorno *et. al.* study indicated a small but significant relationship between educational and occupational status and the amount of authoritarianism evidenced by the subject. The tendency was for lower status occupational and educational levels to achieve higher scores on the F scale.[9] In the larger Canadian study it was also shown that the three criterion groups could be distinguished in terms of their socio-economics class; i.e., the honours, were primarily upper middle class and the failures were primarily lower and lower middle class. Furthermore, as noted above, Gough found that the F scale correlated with social status. These higher scores may reflect greater degrees of anti-democratic feeling among the lower socio-economic groups. Most of the personality traits claimed by Adorno *et. al.* as being the factors subsumed under the authoritarian label may be more commonly present in lower status groups. There is a good deal of research which would reinforce the popular image of the working class as conventional, superstitious, anti-intraceptive and "tough" minded.

However, another factor needs to be considered. Several of the traits which supposedly make up the anti-democratic personality may be positively valued in a culture which intensively stresses competition and achievement. Such traits as conventionalism, authoritarian submission and agression, "toughness", destructiveness and cynicism, projectivity and sex are surely major components in the routine socialization of the

FIGURE I
MEAN NUMBER OF "TRUE" RESPONSES FOR EACH OF THE THREE ACHIEVEMENTS LEVELS



American child. To assume that these qualities represent a significant and pathological divergence from national values, may be a vast over simplification of the factors involved in authoritarian and ethnocentric sentiments.

It is obvious that the culture verbally and legally values democratic sentiment. It is not so obvious that the mainstream of achievement, and the values promoted therein, reinforce or reward democratic behaviour. It may be that there are several value themes which are acceptable and interdependent within our culture. Authoritarian behaviour is routinized and rewarded within many of the established systems in our society such as the military, the schools, government, the business community and the church. Yet these institutions encourage non-authoritarian behaviour in certain permitted areas. Hence to argue that anti-democratic sentiment is more prevalent in the blue-collar segment of society, or that

authoritarian behaviour and values are linked to certain homogeneous personality groupings seems a reduction to the absurd.

Finally it is the opinion of the author that the Canadian ninth graders in the study scored generally at a very high level on the F scale. (mean "true" response=10.72). Could it be that the socialization process in the Canadian sample engenders a higher level of ethnocentric and authoritarian responses? Cross-cultural studies empirically grounding these suggested differences should be undertaken.

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In this article the author presents the results of a study designed to reveal the psychological effects of acceleration, deceleration and failure to accelerate subjects defined as capable of working at an increased rate. The subjects were six year old children who had been given readiness tests prior to admission to grade one. The results seems to show a significant affect upon children who are not accelerated even though they are capable of acceleration and provide further evidence of disservice to individual children due to parental interference with what should be purely professional decisions.

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Acceleration, Deceleration and Self Concepts

The Problem

This study was designed to investigate the developing self concept as it applies to (a) school accelerates, (b) pupils recommended for acceleration but who, for various reasons, did not enter or continue the programme, and (c) decelerates. The definitions of these three groups are functional. Accelerates and potential acclerates are children of superior mental, physical, social and emotional development whose school achievement places them in the top ten per cent of their group during the first six months of school and who, in the opinion of the school, will continue to achieve well if required to complete the first three years of its curriculum in two years. A parent-school conference at the Grade 0.6 level generally makes the final decision as to whether a child is to be accelerated or not. For the purpose of the present study pupils from this group who were not accelerated are potential accelerates. Decelerates are pupils at the opposite end of the development and achievement continuums who, in th opinion of the school, would be best served if required to spend four years completing the first three years of the

curriculum. School decisions pertaining to deceleration are seldom influenced by parent-school conferences so that there are virtually no potential decelerates.

Most personality theorists from Allport's somewhat classical and definitive work[1] to the present are agreed that the self or personality ". . . is shaped in large part by the invironment."[2] Learning theorists maintain that this environmental influence comes about largely through feedback from the individual's behaviour. To the extent, then, that self-development is a function of behavioural feedback, accelerates and potential accelerates on the one hand and decelerates on the other must be different. For, from their earliest intraction with the environment to the Grade 0.6 level both the accelerate and potential accelerate have, in the main, been receiving highly favourable feedback. In the vernacular, they have learned the "anything you can do I can do better" song version. The child who is to become a decelerate has been learning the "anything I can do you can do better" version, for his feedback has been largely unfavourable.

When the child enters school he is given a new-to-him environment that might be considered a fresh start. This new start is, in most cases, accompanied by a strong determination to do well. Then, after six months of endeavour the school makes a formal judgement on the groups with which the present study is concerned. This judgement reinforces and formalizes the "I can", "you can" feedback that has to date been the life history of the potential accelerate and decelerate. The supposition that it will probably have little effect on these two groups seems tenable. It could, however, have change-in-feedback consequences for the child who is accelerated for he now finds himself "promoted" into an older, more mature and more experienced group. The competition is keener both in and out of the classroom and consequently his feedback may now inform him that he is average rather than superior. To the extent that this is true, and to the extent that self-development is a function of feedback, the accelerate should prove himself to be different from his peer, the potential accelerate, between the time when this average feedback "takes" until an excellent set is reinstated by subsequent high achievement.

It was the purpose of this study to investigate differences in self-development among accelerates, potential accelerates, and decelerate groups of children at various stags in the developmental process. For convenience, these groups will be referred to thereafter as A for accelerate, P for potential accelerate and D for decelerate.

Measuring Instrument

Historically, the many non-projective tests and techniques designed to measure numerous aspects of personality have proven to be relatively

unsatisfactory.[3] Lack of sensitivity and/or failure to measure broadly enough, together with non-quantifiable yields were and are among the chief weaknesses of such instruments. Projective techniques overcome the narrowness of coverage weakness inherent in many of the non-projective measures but replaces it with a serious lack of validity.[4] Of the newer, and perhaps better for the present purpose, Q-sort and semantic differential techniques, the Q-sort was chosen because of the relative narrowness of yield provided by the semantic differential approach.

In the light of the major purpose of the study and the characteristics of the measurement technique chosen, it was decided to gather quantifiable data pertaining to: (a) self, ideal-self relationships in the form of "am" and "wish" coefficients of correlation, and (b) ways of relating to the environment through the positioning of factor loaded items, and (c) qualitative data in the form of verbal descriptions also earned through the placing of factor loaded items.

Block's[5] technique for Q-sort development along with Stevenson's[6] proposals contributed substantially to the development of the Q-Tags* instruments used. The Q-Bar (unpublished) developed by Aldridge at the University of British Columbia provided useful data for developing test format while the *Minnesota Multiphasic Personality Inventory* together with numerous other sources provided data for the content of the cards developed for the Q-Tags instrument.

The original sort developed for the study contained seventy-seven items equally distributed among seven personality factors. Item and factor analysis following the administration of this form to some one hundred subjects resulted in a final form containing fifty-four items evenly distributed among six factors: (affective, assertive, effective, hostility, reverie and social). Since children too young to sort the Q-Tags cards were to be studied and since an estimate of both the self and ideal-self was required both an "He is" and an "He should be" edition of the sort was necessary in order that a second person might describe the subject. "I am" and "I wish I were" editions were required for older children who were able to sort the cards. In this way four forms of the sort became necessary and are hereafter referred to as forms "h", "s", "i" and "w". These forms are as identical to one another as possible in items, format, and sorter instructions.

The Sample

Owing to the rate of social change and geographic mobility in the local area it was decided that the current study should be cross sectional rather than longitudinal. In a further attempt to stabilize socio-

*The name under which it is planned to publish the instrument developed for the study.

economic factors it was decided to select all possible subjects from a single school containing Grades I through XII. In categories where more subjects were necessary they were chosn from a two elementary, one junior high and one high school chain of schools located in the same general area of Calgary as the single Grade I through XII school. Table I gives the expected and observed frequencies of subjects in the several categoris for th Q-tags sort.

TABLE I

EXPECTED AND OBSERVED FREQUENCIES IN THE Q-TAGS SORT SAMPLE

Group	September of School Entry									
	1965	N	1962	N	1959	N	1957	N	1954	N
A			V	21 (20)	VIII	19 (20)	X	22 (20)	XIII*	20 (20)
P	I	25 (20)	IV	9 (10)	VII	17 (20)	IX	10 (10)	XII	10 (10)
D	I	22 (20)	III	13 (10)	VI	21 (20)	VIII	13 (10)	XI	11 (10)
Q-tags Sorted by	teacher		teacher		teacher student		student		student	

*First year university students who graduated from the two high schools concerned.

Expected frequencies shown in brackets.

Only teachers who knew the subjects well and who had taught them the majority of their courses in the six months immediately prior to the testing were asked to complete the sorts. All testing was done during March, 1966 in order to obtain ratings on the Grade I subjects (September, 1965 beginners) just before they were informed as to which of the A, P or D categories they would obtain. This timing unified categories A and P into category P for the 1965 group, since they had not yet been segregated, but, since the school was informed of those who would form category D, this group was identifiable.

Having both teachers and subjects submit sort data on the 1959 group provided the possibility of a validation check on the sort. The results of this check will be published separately at a later date. In the meantime, it is assumed that teacher and student sort data are highly correlated.

Test Results

The factorial data obtained on all groups at all levels by teachers and students is summarized in Table II. Table III summarizes the correlation coefficients obtained between sorts "h" and "s" for years 1965 and 1962 and between sorts "i" and "w" for the other three levels.

TABLE II

MEAN FACTOR SCORES FOR EACH GROUP AT EACH LEVEL

Q-tags sort factors		1965		1962		1959*		1957		1954		Mean		
		$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}_t$	s_t	P
	A			44.8	5.2	48.0	10.7	45.5	7.1	43.9	10.2	45.4	7.9	
Affective	P	42.7	3.4	43.7	6.5	46.1	9.6	39.0	8.1	43.2	9.4	43.2	8.9	
	D	57.2	4.9	55.3	7.9	45.0	8.5	45.9	8.8	43.1	8.7	49.9	9.8	
	A			66.5	5.1	59.9	8.2	62.3	6.5	59.9	8.7	62.2	7.0	
Assertive	P	66.7	4.2	64.0	7.1	64.7	8.6	62.0	6.5	59.7	8.6	64.1	7.9	
	D	41.7*	7.9	62.5*	8.5	62.2	9.5	62.4	8.2	59.4	10.6	57.5	11.8	.01
	A			66.1	7.0	51.9*	6.3	53.6	10.4	*69.2	8.0	58.1	7.4	.05
Effective	P	69.9*	2.9	59.0*	9.1	56.1	6.3	61.5	9.2	60.6	10.1	60.6	9.4	.01
	D	38.6*	4.6	47.3*	11.2	50.0	10.9	53.4	7.4	56.4	9.3	49.5	12.5	.01
	A			35.8	8.3	49.1	10.0	45.7	7.4	48.7	11.5	44.8	10.7	
Hostile	P	40.7	2.5	44.2	7.9	44.4	10.4	44.6	8.3	45.1	9.2	43.6	10.1	
	D	58.6*	11.4	44.2*	7.3	50.4	11.4	46.0	9.1	47.1	6.7	49.1	10.4	.01
	A			45.0	5.3	56.6	12.0	54.2	9.9	56.9	9.9	52.6	6.9	
Reverie	P	44.3*	6.5	50.3*	7.2	53.1	11.1	53.3	8.3	53.8	10.2	51.3	8.8	.05
	D	65.0*	6.9	56.9*	10.9	51.2	8.9	53.2	5.7	51.9	9.0	56.2	10.0	.01
	A			65.7	4.5	61.9*	11.0	69.3	10.5	*58.4	8.0	61.3	8.3	.05
Social	P	59.4	2.6	61.7	6.3	59.6	10.4	61.7	7.3	65.2	9.2	61.1	7.9	
	D	63.0	11.9	57.7	9.2	66.8	11.3	63.3	5.3	65.9	7.3	62.7	9.4	

*Scores entered for the 1959 group are those obtained from the student rather than the teacher's sort.

Reading Table II across yields intra-group differences which a vertical reading gives inter-group data.

TABLE III
INTER-SORT COEFFICIENTS OF CORRELATION

Group	September of School Entry					
	1956	1962	1959	1957	1954	$\bar{X}$
A		.42	.27	.21	.19	.27
P	.43	.39	.37	.34	.35	.39
D	−.06	.28	.32	.25	.23	.19

Treatment of Data

Inter-group differences in factor loadings may be obtained by testing for the significance of differences between the total means shown on the right of Table II. Table IV shows the t's resulting from this calculation.

TABLE IV
t OF BETWEEN-GROUP FACTOR LOADINGS

Factor	Between Groups		
	A P	A D	P D
Affective	1.62	3.21*	4.40*
Assertive	1.57	3.09*	4.08*
Effective	1.83	5.78*	7.04*
Hostile	.71	2.89*	3.29*
Reverie	1.02	2.67*	3.13*
Social	.15	1.01	1.13

*Significant $<.01$ level.

In summary, Table IV indicates that decelerates are described by teachers and see themselves as more emotional, more hostile, and more given to day-dreaming than are either the accelerate or potential accelerate groups. The decelerates are described and see themselves as less assertive and less effective than the other two groups. There was no difference in mean factor loadings between the A and P groups, and there was no difference among the groups insofar as their social relationships were concerned.

Owing to the discrepancies in teacher and student ratings at the 1959 level and elsewhere in the study it was decided that little if any information was to be obtained by comparing intra-group ratings as given by teachers and students. For example, the data in Table II is such that the difference between the mean assertive factor scores awarded to the 1965 P group by the teachers and to the 1954 P group by the students themselves is highly significant ($P < .01$). The interpretation of this isolated statistic is that potential accelerates in Grade XII are significantly less assertive than similar students in Grade I. The question, "in whose opinion?" undermines the assertion to such an extent that the present author is not willing to make the claim of difference at all. For this reason, then, only the significant intra-rater-group differences are reported in the probability column on the extreme right of Table II.

The data reported earlier (Table III) summarizes the self, ideal-self relationships. Table V gives the results of converting the overall means of these coefficients of correlation to Fisher's coefficients before t-testing them for significant of difference.

TABLE V
SIGNIFICANCE OF DIFFERENCES IN BETWEEN-GROUP MEAN CORRELATION COEFFICIENTC

Group	$r_{\bar{x}}$	z	Between	t	P
A	.27	.28	A P	.79	$<.05$
P	.39	.41	A D	.50	$<.05$
D	.19	.19	P D	1.38	$<.05$

The magnitude of the t's obtained makes it necessary to accept the hypothesis that there is no difference between the magnitude of the mean coefficients of correlations obtained. It is to be noted however that the difference in self, ideal-self correlation awarded to the P and D, 1965 groups by the teachers (Table III) is significant ($P < .01$). The interpretation of this significance is that teachers are relatively content with the self-development of the P group but that they would make the D group over pretty thoroughly had they the power to do so.

Conclusions and Discussions

1. It is to be noted that no attempt was made to interpret the qualitative verbal yield built into the Q-Tags instrument designed for the study. It is felt that both the verbal and correlation yields of the instrument will prove more useful for guidance purposes and in research with subjects different from those studied here.

2. Owing partly to the limited number of subjects the self, ideal-self coefficients of correlation obtained were not of sufficient magnitude to differentiate among or within the three groups concerned.

3. When teacher and self ratings on factor loadings are combined (Table IV) it was found that the decelerate group is differentiated from the accelerates and potential accelerates who are themselves not differentiated from one another. Decelerates prove to be more emotional, hostile, and given to day-dreaming than the other two groups. They also prove to be less assertive and less effective than accelerates and potential accelerates.

4. The P column in Table II indicates that six of the eight significantly different intra-group awards were made by teachers. The teachers indicate that the 1962 D group differs from the 1965 group in that its members are more assertive and more effective but less hostile and less given to day-dreaming. The other significant changes in scores indicate that the potential accelerates grew less effective and more given

to reverie when not accelerated. Both significantly different scores awarded by the students pertain to accelerates indicating that this group becomes more effective and more socially concerned with the passage of time.

In summary, these changes indicate that in the teacher's opinion decelerates tend to become more assertive and effective and less hostile and given to reverie as they progress from Grades I to III. Potential accelerates who are not accelerated, lose in effectiveness and turn more to reverie between Grades I and III. Students, on the other hand, say that the only significant changes in any group during the Junior and Senior High School years is that accelerates become more effective and more socially concerned as they advance through the school grades.

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This paper delineates some of the problems encountered in testing theory in psychology. The main points touched are: the basic elements of theory formulation; the purpose of theories; the relationship of theories to the aims of science; and the role of models in psychological theories. Passing attention is given to the intervening variable vs. hypothetical construct controversy as it relates to psychological theory. The contribution of Operationism and Philosophy of Science is included in a resume of pertinent considerations in confirmation of the implications of psychological theory.

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Theory Confirmation and the Study of Behaviour: Some Problems

The Aim and the Method of Science

Science attempts to delineate a specified scope and content of a domain in order to discover general laws by which its events can be predicted, controlled and influenced. In the theory of science concern is with the methods and results of empirical investigation. The laws evolving serve to connect observations of facts into a systematic entity. A scientific system is a set of statements or propositions which represent the seeking or discovery effort. In order for a scientific statement to be classified as such it should have presenting evidence or external proof. The process of assembling this evidence is scientific research. When scientific statements are gathered they are arranged by the scientist in a systematic order according to a plan. Then, they are interpreted so that relationships can be formed to construct hypotheses, which will express the laws of nature. From the hypotheses the prediction of future events is possible. It was Comte who said, "*Savoir pour prevoir.*" To know how to predict for the future on the basis of the present is an important aim of the scientist. The structure of a science can be seen as a dual network with two-way communication between the theory data on one hand and, the empirical data or observable phenomena, on the other. The interplay between

theory and empirical data leads to establishment of laws governing the empirical facts. These laws should connect observations of separate facts into a logical system, making possible the communication of knowledge and prediction of new facts and events.[1]

Since prediction as well as control are fundamental characteristics of scientific method the scientist himself must get used to failure as well as success, because in accumulating laws in science, we deal with relationships which are often neither precise nor dependent upon circumstances. Error rears its head. The concept of error in research involves aspects of methodology and measurement important to the scientist. In prediction and control, stated simply, the error must be reduced to a low point where its influence is for practical purposes inconsequential. The distinctive aim of the scientific enterprise is to provide systematic and responsibly supported explanations.[2] What science aims to do has been mentioned briefly and, as well, how it is attempted. It should be remembered that the conclusions of science, unlike common sense beliefs, as Nagel suggests are the products of scientific method. In order to insure valid results some clear view of the character of scientific method is necessary.

(1) A "scientific" procedure is one which involves what in its broadest sense may be called abstraction. (2) It is one in which we seek not only to describe particular things, but also to make general statements of one kind or another, usually including what we call scientific laws. (3) It is one in which there is empirical evidence in support of the statement we make. (4) It is one in which we are concerned with facts, unaffected by considerations about what is good or what is valuable or what ought to be done. (5) It is one in which there is objectivity.[3]

If we conceive of science as the communication of knowledge and predicting new facts as stemming from a logical system, then the establishment of laws from which facts can be deduced would be desirable. A system of such laws constitutes a scientific theory that is said to be an explanation of the empirical facts.[4]

The Role of Theory in Psychology

The formal theoretical method involves observation, hypothesis, experiment and verification. In evaluating theory, Bacharach proposes three different sets of operations: (1) Empirical propositions which are statements of fact observed; (2) Hypothetical propositions which are statements of conjecture based on the observer's empirical proposition; (3) Theoretical propositions which are statements of the functional relationships among variables.[5]

The approach to defining theory varies from simplified or parsimoniously stated to much more rigorous and demanding qualifications. According to Bergmann,[6] there are no articulate and comprehensive theories

existing at present in psychology. It is his view that a theory in psychology, as elsewhere, is a set of laws deductively connected, that is, some of these laws, called basic laws or axioms, allow jointly for the deduction of the others, called theorems. And, of course, a theory permits also the deduction of laws as yet untested. In a briefer view, N. E. Miller[7] sees the criteria of a scientific theory as a system of symbols in verbal or other form, only if one can use it to make rigorous deductions about some of the consequences of different sets of conditions.

Kerlinger[8] outlines a theory as a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting other phenomena. Here the link is established with the purpose of science. It will be remembered the principle objective of a science, other than the description of empirical phenomena, is to establish, through laws and theories, general principles by means of which the empirical phenonena can be explained, accounted for and predicted. In carrying out this objective, sciences concern themselves with gathering and comparing data "in order to establish the correlations, mathematical equations and, theories that are the goal of inquiry."[9]

The concept of axiomatization which is found inherent in the more rigorous theoretical attempts tends to be gaining some ground especially where logical structure and confirmatory evidence are important. By axiomatization is meant the reconstruction of a scientific discipline in the form of a deductive system with postulates, definitions and derviations precisely stated. As Feigl writes:

> The generally accepted account of theories as hypothetico-deductive systems has been logically reconstructed in fairly similar ways by M. R. Campbell, H. Reichenbach, R. Carnap, C. G. Hempel, R. B. Braithwaite, H. Margenau, F. S. C. Northrop, H. Melberg and, others in terms of postulates and correspondence rules ("coordinating definitions," "epistemic correlations," "dictionaries," "interpretive systems.") The basic idea here is that one may conceive a theory as an (erstwhile) uninterpreted calculus.[10]

From a perspective of discovery and utility Kaplan sees a theory as a way of interpreting, criticizing and, unifying established laws, modifying them to fit the data unanticipated in their formulation and, guiding the enterprise of discovering new and more powerful generalizations.[11]

Kaplan emphasizes the more overall, pervasive role of theory, including the process of scientific inquiry itself; thus broadening the role of theory and making it more functional. Along the lines presented by Kerlinger and Kaplan, Marx sees a need for a greater recognition of the role of theory in psychology and postulates theory serving as a tool, to organize empirical knowledge. He sees three elements of all scientific theory construction; (1) observations—which must be under controlled conditions, (2) constructs—which must be operational, (3) hypotheses—which must be testable (that is, clearly disconfirmable).[12]

The discovery emphasis stresses the heuristic view.

> The process involved is two way with theory and conceptual schemata interconnecting and supplementing each other to provide fruitful data leading to further research. As Conant (1951) points out the usefulness of all scientific hypotheses lies in the research they generate. There is an interrelatedness between theory and hypotheses. It can be perhaps thought of as an isomorphism. Going one step further and, in broad terms we note the words of Boring (1953) who considers psychology "as theory just as science is theory—descriptive theory sometimes and, explanatory theory at other times, yet theory, because it is concerned with constructs that are things and their relations. Psychology and science are theory empirically based."
>
> Theory in the narrow, the tool sense is the immediate basis of experimentation. It is the specific formulation of the problem—the overt reason for undertaking the work. By means of it the experiment is designed.[13]

It is well known that Skinner questions theories. Actually, Skinner is concerned with theories and theoretical concepts regarding, essentially, whether scientific laws should contain low order or high order concepts. Skinner argues for low order variables. According to Bergmann, the belief that an empiricist must not countenance high order concepts has been overthrown long ago. It seems that Skinner's position holds that greater emphasis should be placed on the relevant variables of psychology and their experimental importance, rather than on theoretical constructions. The underlying issue in his position tends to be an expression of an inductive approach called the positivistic view. It is the method of data leading to inductive theory. Skinner is joined in this approach, as well as in critical attacks on the classical, formalistic procedures by Egon Brunswick and Murray Sidman.

> On the positive side, this point of view holds if we only develop our facts carefully enough, theories—as generalized, inductive principles summarizing empirical relationships—will take care of themselves. For the strict positivist, theories are nothing more than summary statements, and to try to produce them too far in advance of the acquisition of the facts themselves is therefore a serious mistake.[14]

Familiarity with the diverse problems of psychology renders indeed an appreciation of the large amount of unknowns in the field. Much of the data of psychology is still open to serious debate, and the dust has not begun to settle. Because many empirical studies are concerned with entities in themselves not observable it does seem there is ground for caution. When the statement is made that theories can be produced too far in advance of the acquisition of the facts, then the question follows—does theory lead to research and empirical confirmation or do the latter, research data, lead to theory? The tool and goal function of theory appear to be permissive of psychological inquiry, proceeding either way. When Skinner[15] says, "Research designed with respect to theory is also likely to be wasteful," he is arguing against the practice, mostly carried on in thesis research, where the idea is that research tends to be aimless

unless there is a guiding theory as a foundation. It is his position that scientists do not always work from the pattern of hypothesis, deduction, experimental test and confirmation.

What we are concerned with in the role a theory plays is how well it relates to the scientific process. Does it guide and stimulate the ongoing process of scientific inquiry? Does it raise new questions? The theory in science should serve to open the way to new knowledge, organize the known data and, lead to further inquiry. Theoretical constructs are essentially a means of establishing the laws of nature[16]

While Skinner claims a theory will eventually be overthrown and this view is quite supportable, another way of looking at it, that is in defense of theories, is presented by Barker, *et. al.*, when they reported that:

> It is an essential characteristic of a fruitful empirical theory that it gives birth, as it were, to new knowledge, which is then independent of its theoretical ancestry. The fruitful empirical theory is instrumental in establishing new scientific data which should be able to outline the theory.[17]

Thus the notion of giving birth to new knowledge is stimulating and justifiable in terms of a desirable goal of scientific inquiry.

That psychology is still dealing with many complicated problems of scientific theorizing, scientific methodology and generally ordering the discipline has been pointed out. What is important to keep in focus is that psychology is basically concerned with the discovery of the general laws of behaviour. Spence summarizes the task under five headings: (1) Theory is still at a very primitive level in psychology, concerning itself primarily with the discovery of low order laws. (2) There are a variety of different theoretical procedures possible in psychology. (3) Some psychologists substitute, often quite unconsciously, phenomenological introspection and anthropomorphic thinking for theorizing. (4) Many theories in psychology have provided us with response-response (R-R) laws rather than stimulus-response laws (S-R). (5) The most promising theoretical technique, is the so-called "intervening variable" method proposed by Hull and Tolman.[18]

According to Hebb and, this statement is a good summary note on theories, "my argument is that it is only with the rubble of bad theories that we shall be able to build better ones and, that without theory of some kind, somewhere, psychological observation and description would be at best chaotic and meaningless."[19]

The Model and Its Function in Psychology

When questions are asked such as, "What is a model?"—"What is the function of a model in psychology?" all sorts of difficulties present themselves because the answer depends to a large extent on the training,

tastes and, dispositions of the answerer. Also, the purpose the model will play is important.

The question of whether theoretical models are necessary was asked by Von Bertalanffy, who suggested an affirmative reply, but at the same time considered the limitations involved. It was his view that model conceptions in psychology should be: (1) Essentially dynamic, although including structural order, established by progressive mechanization, as a derived yet most important case, (2) Molar, though allowing for molecular interpretation of the individual processes; (3) Formal, though allowing for future material interpretations.[20]

It cannot be our purpose here to trace the history of models in science. Models are nothing new. Their use dates back to Aristotle and Descartes. According to Chapanis[21] there are only two kinds of models: replica models and symbolic models. Models express the entities of the theory. The essential idea of a model is that it is accompanied, so to speak, by a commentary which qualifies or limits—but not precisely nor in all respects—the analogy between the familiar objects and the entities which are being introduced by the theory.[22] In psychology, it is fairly well accepted that a model is a conceptual analogue, sometimes borrowed from another field, such as mathematics or statistics, facilitating the research effort. A model can serve as a focal point or fulcrum involving actions going in two directions. It may serve as a guide for setting up assumptions of a theory and, can serve as a source of suggestions for extending the range of their application. A model may refer to the postulates or hypothetical ideas of a theory, it may further clarify inferences of a theory, or refer to a mathematical calculus.

The functions of models can be analytically categorized as, (a) inferential; (b) representational; (c) interpretational and, (d) pictorial.[23] A different kind of arrangement but similar and illuminating is the interpretation of Kaplan, who talks of physical models, semantic models, formal models and interpretive models. The important issue is that any model is related to the empirical evidence. As Tolman pointed out earlier, we all have models in the back of our heads when we collect systemic sets of data. As if to answer Tolman, Kaplan writes:

> As inquiry proceeds, theories must be brought out into the open sooner or later; the model simply makes it sooner. In the Socratic metaphor, all thought is the conversation of the soul with itself. The creative imagination, in both scientist and the artist, takes the form of a vigorous discussion with the boys in the backroom; and there inevitably comes a time when someone says, "Put up or shut up!" It is at this moment that models are brought forward.[24]

Before presenting examples of how models are used in psychology it is well to point out that models are not infallible or "cure-alls" in

theory research. Briefly some dangers are: over generalization committing a logical fallacy, incorrect relationship between variables, incorrect constants assumed, non-validation of the model, and diversion of energy into non-productive activity.[25]

With the above cautions in mind, a look at a few models will serve to show the utility of such conceptualizations. The most characteristic role of mathematical models is to provide a logical route to go from the entities of the real world to predictions about it.[26]

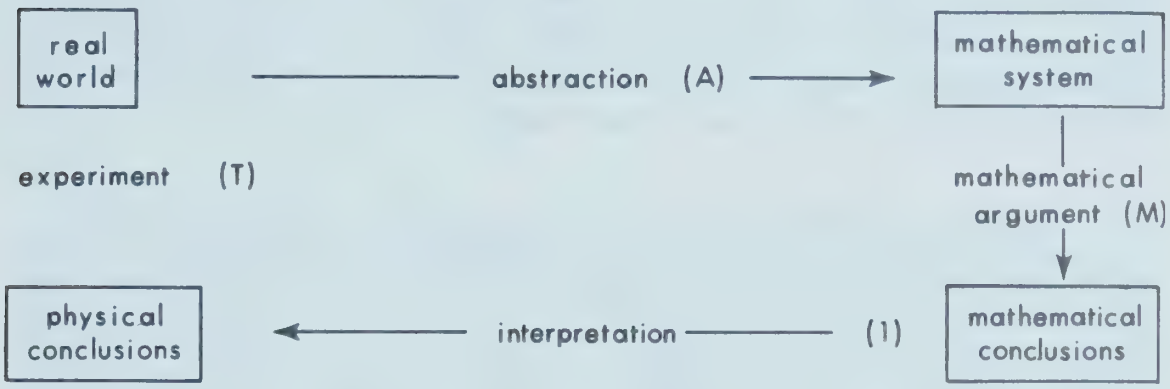


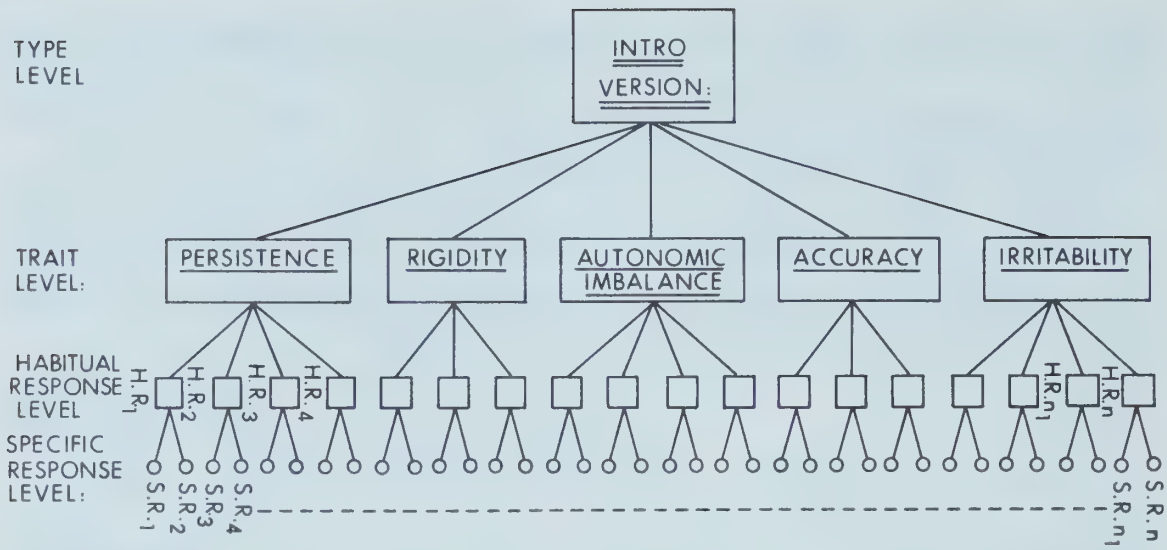
Figure 1. The symmertrical roles of experiment and mathematics.

Coombs, *et al,* attempt to show how the use of more general models can extend the domain of classical measurement theory. The writer feels an insight into what is being proposed by these investigators tends to be similar to an interesting recent view by Eastwood, who, in describing a "systematic inquiry model" states:

> Systematic enquiry, the end product of which is explanation rather than the solution of specific problems, may be conceived as a four dimensional system. This system is a general model that provides the framework for the derivation of specific models from which testable hypotheses can be deduced.[27]

Eastwood's system is a departure from the analogue approach usually found in psychology. The four dimensions are: (1) the referential, (2) the theoretical, (3) the experimental and, (4) the validational. One advantage of the systematic inquiry model is the degree to which the efforts of the investigator are facilitated. He can operate in a controlled situation, but remain free from prior conceptions. The referential domain embraces the total set of entities constituting the extent of the area of inquiry. The referents are co-ordinated definitionally, by definitional forms, to signs or symbols, to constitute the vocabulary of the system. The theoretical dimension involves producing axioms which are logically testable and lead to general hypotheses. The experimental dimension provides for rejection or non-rejection of hypotheses. The validational dimension subjects the explanations to actual situations.

The construction of a model of personality can be seen nicely if one examines Eysenck's[28] attempt.



Four main levels of organization are depicted: (1) Specific Response Level, (2) Habitual Response Level, (3) Trait Level, (4) Type Level. In constructing a science of personality, we must seek for abstract models, concepts, mathematical functions, or what have you, which will adequately represent our knowledge—meagre though it be—of existing facts, and which at the same time will point toward new facts, which can verify, modify, or refute our theoretical model.

A mathematical model is frequently employed to serve in behavioural contexts. An example is Meldman's Ego model. Basing his assumption on the statement that the most elementary form of the ego is the phenomenon of attention, Meldman states:

> . . . we can then formulate the expression that the ego (E) can be operationally construed as a summation of its elementary form, one attention unit (M), which can be expressed E=EM. Based upon the libido theory, it seems reasonable to postulate an excitatory or facilitating attention (cathexis) as well as an inhibitory attention (counter or anti-cathexis). The equation can then be expanded to $E = (Me + M_1)$ where Me represents excitatory attention cathexis and M_1 represents the inhibitory attention counter cathexis. The mathematical formulation of the ego becomes $E = (Me + M_1)$ where E represents ego, Me represents excitatory attention cathexis and M_1 represents a summation of the inhibitory attentional counter-cathexes.[30]

There is considerable discourse in psychology today about theories with emphasis on extremely formalistic approaches involving postulate systems, constructing uninterpreted calculi and, other details falling under the heading of logistical strategies. In practice, a theoretician does not always go about the construction every time in that way. Skinner points this out as does Sellars who notes the fundamental assumptions of a theory are usually developed not by constructing uninterpreted calculi which might correlate in the desired manner with observational discourse, but rather by attempting to find a model, i.e., to describe a domain of familiar objects behaving in familiar ways such that we can

see how the phenomena to be explained would arise if they consisted of this sort of thing.[31]

This paper cannot go deeply into the various arguments about whether models in psychology should be physiological or non-physiological. Such guidelines can properly fall under the heading of reductionism. However, it should be pointed out that in theoretical psychology, a branch of the philosophy of science, there is support that "logically and in principle, physiological reductionism is a certainty."[32] The principal at stake is the choice (especially in personality theory) between a neurological versus a formal model. Hebb, Krech and Klein, to name a few, argue for the physiological approach. On the other hand, theorists such as Tolman, Von Bertalanffy, Parsons and Shila press the case for formal models.

The more basic question is, what good are models? What has been said up to this point can be condensed to express several useful functions. We are indebted to Chapanis[33] for the gist of his argument: models (1) describe and help us to understand complex systems or events, (2) help us learn complex skills, (3) provide the framework within which experiments are done, (4) help us to see new relationships, (5) help us to predict when experiments are impossible, (6) assist in engineering design, (7) amuse us.[34]

The application of numbers 1, 3, 4 and 5 are of greatest relevance in the testing of theory via its model conception. A major mode of theory development is the use of a model, or conceptual structure, usually borrowed from some other field, whereby empirical investigation is provided firm guidelines, but strictly speaking, no effort is made, as Marx stresses, to test the truth value of the model itself.

The Intervening Variable vs. The Hypothetical Construct Constroversy

The questions which are generated in psychology, the continuing arguments over which way theories will go, how they are constructed, what their components are, to a large measure, tend to centre around the confusion involved in the issues of variables and constructs. For clarity of discussion, a variable is a class of objects or evnts, or properties thereof; a factor or condition that is conceptualized for scientific purposes. On the other hand, a construct is usually conceived of, briefly, as being a concept representing relationships among events or things and their properties. Psychology goes about its work in explaining behaviour through laws, theories, postulates and axioms, with an empirical base. Notice the following statement:

$$B = f_1 (S,P,H,T,A)$$

The initial causes of behaviour consist of five independent variables.

S = environmental, P = physiological drive, H = heredity, T = previous training, A = a given age or maturity.

The function (f_1) is broken down into a set of mental processes called "intervening variables." Thus, did the behaviourist Edward Tolman introduce intervening variables in 1932:

> The intervening variables are the determinants of behaviour. They are divided into (1) immanent purposive and cognitive determinants, (2) capacities and (3) behaviour adjustments. They cannot be directly observed, but they can be inferred from behaviour. They are to behaviour as electrons, curves, or whatever it may be, are to the happenings in inorganic matter.[34]

The inferred processes are between the independent variables (stimuli, etc.) and the dependent variables (responses, etc.).

Clark Hull, the exponent of the hypothetico-deductive approach employed Tolman's intervening variable principle. He postulated habit strength (sHr), drive (D) and reaction potential (sEr). Hull's Postulate VIII, the Constitution of Reaction Potential is an illustration.

$$sEr = D \times V_1 \times K \times sHr$$

Here, Hull is indicating: the reaction potential (sEr) of a bit of learned behaviour at any given stage of learning, where conditions are constant throughout learning and response-evocation, is determined: (1) by the drive (D) operating during the learning process multiplied, (2) by the dynamism of the signalling stimulus trace (V_1), (3) by the incentive reinforcement (K), and (4) by the habit strength (sHr).

Intervening variables are abstract concepts of behaviour theory for which no physiological interpretation is offered, explicitly or implicitly, in spite of Hull's physiologically sounding nomenclature. Hypothetical constructs are intervening variables that are physiologically interpreted or located inside the organism.[35]

The difference between intervening variables and hypothetical constructs is, according to Marx, seen as the degree of operational acceptability and the degree of reality status.

MacCorquodale and Meehl attempted to draw a distinction, in their famous paper, between intervening variables and hypothetical constructs. They pointed to Skinner's "reserve," Tolman's "demand" and Lewin's "valence" as examples of pure intervening variables. Hypothetical constructs for these writers did not fill the requirements of three conditions:

(1) contains no words which are not reducible to empirical laws; (2) the validity of the empirical laws involved is necessary and sufficient for correctness of statements regarding the concept; (3) suitable grouping of terms in the quantitative empirical laws will produce a quantitative expression of the concept.[36]

Briefly stated then, Marx sees intervening variable as meaning any construct with a maximum amount of operational validity, or direct empirical reference and, by hypothetical construct is meant any construct with a relatively low degree of operational validity. Marx has cautioned that a clear cut distinction cannot always be drawn. Ginsberg, clarifying the matter, or further adding to the confusion, if you prefer, asks the question, "Are there significant logical differences between intervening variables and hypothetical constructs?" His view is that the proper grounds for distinguishing between intervening variables and hypothetical constructs derive from the differences between a law and a theory.[37] The equating tends to boil down to: intervening variables are referrable to laws while hypothetical constructs refer to concepts which are part of a theory. While accepting the contribution of MacCorquodale and Meehl, Lindzey questions whether intervening variables and hypothetical constructs exhaust the varieties of theoretical or analytic constructs that may be used. Lindzey argues that there are constructs employed by theorists which are more than intervening variables but less than hypothetical constructs.[38] They are called conventional constructs. Some examples are: Mosteller-Bush statistical learning theory constructs, Spence's use of reinforcement learning theory constructs, Brunswick's probabilistic concepts and, perhaps certain psychonalytic concepts such as libido.[39]

The hypothetical construct and the intervening variable are of functional interest to the investigator who is concerned with theory construction or theory confirmation. As long as it is scientifically useful to organize theory within the framework of the intervening variable paradigm, the theorist ought to be left free to direct his creative scientific thinking to the goals which he has determined.[40]

In an attempt at further precision in meaning, Rozeboom stresses an analytical relation:

> An intervening variable (transformation variable) is a variable which has been systematically defined in terms of its antecedents and is hence dependent upon the latter for its meaning. To recapitulate the analysis by means of a formal example, let us suppose that $z = (x + y^2)/w$ is an empirical relation expressing the best esimate of a known variable z as a joint function of other known variables w, x and y. We are now able to express z as a function of analytical mediation variables by defining one or more of these as mathematical functions of w, x and y.[41]

The idea here is that the intervening variable becomes an operationally definable concept without surplus meaning. Hypothetical constructs do have surplus content and are inferred mediation variables. They are not analytically contained in their antecedents. Henrysson suggests hypothetical constructs are of value and are useful in scientific theories. Scientific theories, which work with such hypothetical constructs, have, in most sciences, been very fruitful also for further empirical research.[42]

The Role of Operationism and Logical Positivism in Theory Research

A model does not become a scientific theory until a sufficient number of its items has operational or epistemic definition.[43] Operationism, a method of observation, was introduced by Bridgman in an attempt to define concepts of science by improving the rigour of scientific language through defining the operations that produce them. The concern is with the language. An effort is made to define the concepts so that they can be stated and tested by other observers. There is implied a two pronged attack: not only the observation but also the operations performed by the observers. Operationism came forward as a revolution against absolute and undefinable concepts in physics. The basic idea of operationism was uncomplicated. It provided, not just a criterion of meaningfulness, but a way of discovering or declaring what meaning a particular concept has; we need only specify the operations that determine its application.[44]

Margenau, makes a distinction between constitutive and operational definitions. A constitutive definition defines a construct with other constructs, whereas an operational definition assigns meaning to a construct or a variable by delineating the activities or operations which are required to measure the construct or variable. An operational definition is a sort of manual of instructions to the investigator saying, "Do such and such in so and so a manner;" briefly it defines or gives meaning to a variable by spelling out what the investigator must do to measure the variable.[45]

While operationsim has its merits in certain applications to the problems of theory construction and empirical validation through clarity and meaningfulness of concept, the method itself is not without its critics. These critics tend to express dissatisfaction with strict operationism. Hempel feels that a narrowness in science is fostered by the view that all concepts be operationally defined. Hempel is joined by Feigl and Scriven in this acceptance of a relaxation in rigid observation. "A term is fruitful only if it encourages change in its own meaning; and, to some considerable extent, this is incompatible with operational definition.[46] Psychologists are beginning to adopt the point of view that the adequate definition of many psychological concepts can only be approached gradually by a system of successive approximations (construct validity). . . .[47]

Thus, with the pros and cons of operationism it seems that the theorist must tend to his immediate aims and goals realizing certain criteria must be assessed for their value in terms of his purposes. What cannot be denied is that psychologists are moving closer to more efficient solutions to methodological problems. Operationism, as put forth by Bridgman,

greatly influenced such theorists as Tolman, Stevens and Skinner. In this trend the empirical component of the scientific method is stressed. On the other hand the movement of Scientific Empiricism, influenced by the ideas of Russell and the Vienna Circle finds expression in Hull and Tolman's formulations. The Vienna Circle members were concerned with purging philosophy of its metaphysical elements and substituting for it an investigation of the rules of language in the formulation of scientific propositions.

Logical Empiricism, according to Feigl, makes its most important and constructive contributions in the logic and methodology of the sciences. The foundations of logic, mathematics, physics, biology, psychology and of the social sciences have been penetrated in an unprecedented manner by the work of Schlick, Carnap, Reichenbach, Wittgenstein, Frank, Von Mises, F. Kaufmann, Hempel, Woodger, Brunswich, Lilsel, Popper, Nagel, Kaplan, Braithwaite, Pap and many others.[48]

The Logical Empiricists are concerned with clarification of the language of science and a study of the conditions under which empirical propositions are meaningful. The lesson to be learned in the sowing of such diverse seeds into the fields of psychology is cross-fertilization. What are the seeds? The first is Operationism; followed by the philosophical movement exemplified by the Vienna Circle, then the Logical Empiricists. An attempt to translate propositions into a physical language is the central idea of Physicalism. Translating sentences into an all-inclusive language results in a universal language of science. Here we have the Unity of Science. Admittedly, the details of such movements need far more explanation than space permits here. But, the pointing out of the current trend suffices to show the way of the theory builder and tester. So with these contributions we arrive at the Science of Science, or the Scientific study of science. As S. S. Stevens says:

> . . . It now appears that the Science of Science emerged as the reasonable outcome of revolutions in the three major fields of physics, psychology and philosophy. Operationism as a revolution against absolute and undefendable concepts in physics, behaviourism as a revolution against dualistic mentalism in psychology, and Logical Positivism as a revolution against rational metaphysics in philosophy where the three forces whose convergence into a common effort is effected by the Science of Science.[49]

The Case for a Modified Approach

In an attempt at an operational reformulation of some of the basic principles of psychoanalysis, Ellis reviewed some of the main problems involved in scientific theorizing. He re-stated many of the Freudian hypotheses in operational terms. The writer of this paper sees value in some of the limitations of strict operationism and strict empiricism. Theories should not be strictly limited to observational, intervening variable, dispositional, strictly inductive, or low-order terms, since this kind

of rigid operationism would at the present time, unduly restrict scientific thinking and investigation.[50] In calling for a modified operational approach the following points give the gist of the argument: (1) To be operationally meaningful, a statement must be, at leasts in principle, confirmable. (2) In modern operationism or empiricism we can no longer demand full verifiability or full falsifiability of scientific statements. It is more realistic to demand only confirmability or partial verifiability. (3) So-called intervening variables are legitimate and fruitful in scientific theorizing, but they have distinct limitations. (4) A modified operational approach leaves room for a less strict, non-Skinnerian form of psychological theory. (5) Psychoanalytic (or other psychological) theory need not be presently stated in neurophysiological language. (6) Retention of, as an integral part of the scientific method, creative hypothesizing, while recognizing that it is, in the last analysis, a form of unconscious or secondary induction. (7) Simplicity is a desirable but not an essential requisite of scientific theorizing, serving a useful purpose; but in itself it does not guarantee the formulation of the best kind of theory. (8) From the standpoint of a modified operationism or empiricism, it is legitimate to formulate speculative theories; but it is questionable whether they should be defended on "heuristic" grounds, since it is virtually impossible to define or confirm accurately what is or is not "heuristic".[51]

The essence of the modified approach appears to adhere to the aims of science while still allowing for latitude as well as creativity in theorizing. At the same time the undesirable elements of speculation based on metaphysical foundations is methodologically and from the basis of theory, eliminated.

The Role of Parsimony and Simplicity

A word should be said about the role of parsimony in theory methodology. Again, if a conscientious effort is made to survey the literature of psychology the various directions taken by writers and investigators branch out in geometric proportions from the starting point of William of Ockham's Razor and more specifically in psychology itself, Lloyd Morgan's canon. The theme is the acceptance of the simplest of alternative explanatory propositions. The application of parsimony aids in developing theories having sufficient empirical support. Frequently, it is found that a confusion exists when the terms parsimony and simplicity are used in connection with theories. At various times the term simplicity refers to a selection of one of two theories based on certain criteria while at other times simplicity refers to elements within a theory and concerns the relative parsimoniousness of the constructs. The important role played by the principle of simplicity as an adjudicator between rival scientific theories has been widely acknowledged. There seems to be complete agreement between philosophers that it is one of the basic

rules of scientific methodology not to multiply unnecessarily the entities admitted into one's theories, and to choose always the simplest of alternative hypotheses.[52]

Another vantage point is stressed by Reichenbach who adds, "There are cases in which the simplicity of a theory is nothing but a matter of taste or economy."[53] In his discussion Reichenbach posits two kinds of simplicity: descriptive and inductive. To exhaust the positions on parsimony and simplicity cannot be our aim here. Thus, to look again at point eight of Ellis' modifications the reader is left with the summary statement which bears repeating. It would appear, then that simplicity is a desirable but not essential requisite of scientific theorizing; that it often serves a useful purpose; but that, in itself, it does not guarantee the formulation of the best kind of theory.

Testing the Implications of a Theory: A Brief Overview

Theories are usually considered testable in terms of the "reduction" of the theory to hypotheses which are isomorphically related to the theory. The validity of the hypothesis usually rest on successful empirical prediction. So far, this paper has attempted to cover some of the elements involved in the methodology of theory construction, the constituent elements of theories, the model and its usuages, along with attendant problems relating to variables, constructs and the criteria imposed by Operationism and Empiricism. Finally, the theory, or more broadly its implications must be brought out into the light for inspection.

It does not take much argument to show that the usual method of confirmation of a hypothesis by empirical test can be accomplished only in purely deductive systems, if the method is logical. The scientific manner tests the hypotheses while the positivistic style asks a question. It is frequently efficient to translate the theory to the hypothesis level for testing. Some investigators use the intermediary step of employing the model to test a theory. In that case the model may be subject to change but not the theory. That is, the model is a tool to be used heuristically. As Torgerson pointed out, "when certain of the constructs are connected to the empirical world by rules of correspondence, the model becomes a theory and, as such, is subject to empirical test."[54]

The major caution involved in testing theories has been outlined by H. M. Johnson when he says that:

> . . . to argue to the truth of an hypothesis by affirming the consequents is always a fallacy no matter how many consequences are affirmed. We are at liberty to entertain such hypotheses as have not been falsified by the observed failure of their consequents, but we may discard them whenever we find others that are more fertile or more simplifying. Inductive reasoning does not establish the truth of its hypotheses. Even if the hypothesis is false, half of its implicates will be true. But to say this is not to deny the value

> of hypotheses. They reveal interconnections between events and, through these interconnections, they suggest experimental procedures by means of which implicates can be verified or disverified. The verification or disverification of the implicates is important and useful in its own account, for by it, we discover something about the world in which we live, but the verification of the implicates does not establish the truth of the hypothesis.[55]

The argument of Johnson is of course, valid. It should be noted that while he is frequently quoted as pointing out the fallacy of affirming the consequences, he also emphasizes the value of hypotheses. McGuigan also concurs that testing theory through the current method, inference by confirmation, is an invalid procedure.

It seems especially important to stress a source of confusion in looking at the usefulness of a theory. This problem relates to the processes of verification and confirmation.

> Confirmation allows classification of a theory as probable or improbable, and requires that we consider a number of separate evidence reports; while verification allows classification of a theory as completely true or completely false, as based on only one evidence report. Verification, therefore, is a narrower term than confirmation and, may be included as a limiting case of confirmation where the probability is 1.0.[56]

The important caution to theoreticians is the *tentative* nature of a theory. Theory is a stage. It is a *working model* subject to change and modification and, even overthrow. It should not *dominate* the empirical data. If it becomes rigid it loses its value as supporting the advance of science, the seeking of truth and establishing the laws of nature.

According to Popper, the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability. The crux of his position is: (1) It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations. (2) Confirmations should count only if they are the result of *risky* predictions. (3) Every 'good' scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is. (4) A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice. (5) Every genuine test of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability. (6) Confirming evidence should not count except when it results from a genuine test of the theory. (7) Some genuinely testable theories, when found to be false, are still upheld by their admirers.[57]

Keeping in mind Johnson's argument regarding the fallacy of the usual method of testing a theory or hypothesis, as reinforced also by Miller, McGuigan and, Turner, the question is asked, if this is a serious limitation, what do we do? Unless one is concerned with ultimate truthfulness—a kind of philosophical Holy Grail—empirical verification should be sufficient.[58]

Summary

Some of the problems encountered in testing a theory have been discussed within the limitations of efficient use of space. The role of theory, models and constructs was examined. Confusion present in psychology was discussed as it relates to the intervening variable vs. hypothetical construct controversy, and the influences on psychology generated by Operationism and the Philosophy of Science. A modified approach as stated by Ellis was seen as a desirable answer to strict Operationism and Empiricism. Finally, a few of the considerations in present literature regarding theory confirmation were brought forth. When the reader tests a theory—he can take his choice.

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BOOK REVIEWS

"IDEOLOGY AND ANALYSIS; A REHABILITATION OF METAPHYSICAL ONTOLOGY"

By: Richard C. Hinners, (New York: Desclee de Brouwer, 1966)

Hinners in this book paints with a 6-inch paint brush. He attempts a grand synthesis of all that has gone before him, a synthesis which culminates in the claim that we cannot do metaphysical ontology without recognition of the infinite presence of He Who Is. He does concede in his Preface (p. 15) that 'the reader should not expect to find here a fully-fledge system of philosophy'; I would suggest that the reader should not expect to find anything very much at all. That way the reader will not be very disappointed. Much of the book is historical exegesis which is either standard diet or wrong; the rest is unhelpful and very often obscure generalization.

I shall pick upon one or two points where Hinners is specific enough for one to get to grips with him, and indicate how I find what he says to be unsatisfactory. Ideology and Analysis he takes to be names of two opposing tendencies in philosophy; these are the tendencies he is trying to synthesize. Traditional Greek metaphysics he labels as "ideological" (*cf* Chaps. 2-4) because it is, to use a word with which readers might be more familiar, 'theory-laden'. It is committed to the *value* of speculative metaphysics, but this, says Hinners, is a point of view we are free to reject. True philosophy should not have this sort of ultimate commitment. However, I doubt that his own remarks are any better, as I shall shortly indicate. Analysis, on the other hand, is inadequate (*cf* Chaps. 7-9) because it cannot deal with "lived experience", some inner experience of the subject which is logically prior to the public world that forms the material for analysis.

Hinners' *tertium quid* here depends very heavily on his own presupposition, which is that only an intentional analysis of meaning is correct. This leads him to talk in almost the same breath of "verbal formulae whose meaning is yet to be determined" and "meaning" as an activity we are engaged in (Pp. 28-29). This analysis of meaning, to my mind at least, was shown to be quite inadequate by the later philosophy of Wittgenstein: Hinners shows absolutely no awareness of possible objections to his own view. Significantly, Hinners does discuss and criticize the logical atomism of the *Tractatus,* Wittgenstein's earlier and, as he said himself, confused work (Pp. 203-216), on the grounds that "articulate discourse" presupposes more than names and nominata. What Hinners does not realize is that this objection holds against *any sort* of intentional analysis of meaning including his own, not simply against that of logical atomism.

Let us leave these points and, see how Hinners attempts his synthesis. "Being as Presence" is the crucial concept here and also in the attempt to give a Christian basis for any true ontology. Presence is "the consequent object of speculative existence which is the existential-empirical realization of logically projected possibilities of experience" (Pp. 202). I shall try to interpret this splendiferous jargon. Pure speculation ignores actual facts: excessive concern with the here-and-now blinds one to the range of possibilities that are open, particularly in the future. The present, as opposed to the existent, is that which is comprehended by one who can take both of these views at once. The possibilities are produced by speculation, considered by analysis and "given" by lived experience. Insofaras presence is not simply lived experience, it transcends lived experience, and so is fit to be an object of a metaphysical ontology (Pp. 217 ff); any claim that Hinners' philosophy is not 'theory-laden' looks pretty silly beside *that* remark. (Insofaras it is not simply an array of logical possibilities, presence is doubly transcendent and, so is infinite presence (Pp. 223). From there we progress to He Who Is as being infinite presence (Pp. 264 ff). A synthesis of this sort is not possible except on an intentional analysis of meaning. I believe that such an analysis is wrong and, so I would reject Hinners' synthesis as fundamentally misconceived. This means, certainly, that the problem of reconciling existence and essence is forever with us. I acknowledge this, but feel philosophers would spend their time better in bringing men to accept this, rather than in trying to synthesize the problem away.

Hinners' presuppositions come out again in a couple of places in his historical exegesis. He presents Plato's *Euthyphro* as a piece of philosophy which illustrates his own ideas. Socrates asks Euthyphro, "What is Piety?": Euthyphro replies, "Piety is doing what I am doing" (viz., prosecuting his father for the murder of a slave). The simplest interpretation of Euthyphro's remark is "An example of a pious act is prosecuting one's father for the murder of a slave". But this is too simple for Hinners: he writes, "Euthyphro points to that which is to be communicated, the lived experience of a pious act" (Pp. 65). For us, Euthyphro offers an example of piety: for Hinners, Euthyphro commits himself to being a living example of piety. The meaning of "piety" is for us given in the words Euthyphro uses: for Hinners, it is given in Euthyphro's engaging in some activity. The presuppositions about intentionality are quite evident here.

In his remarks on Aristotle, Hinners is unable to see him except through the eyes of Thomistic theology. There is one respect in which this is useful, in that it causes Hinners to bring out the similarities between Aristotle and Plato; these similarities are often obscured by commentators who paint Aristotle as a hard-nosed empiricist and anti-Platonist. But Hinners goes too far the other way. Although Aristotle does deny that Being is a genus, one thing he does not do, it seems to me, is think of the "object of ontology as a transcendental, in that it surpasses any kind or type of reality" (Pp. 177) that is reducible to species

and genera. Substance, or Being, is, for Aristotle, a category by which to look at sensible particulars, but one which includes them all, whatever other individuating characteristics they have: in this sense it is not a genus. But the objects of ontology are the objects of any other enquiry; they are just viewed differently in an ontological discussion. There is no question of "a reality beyond sense-experience" (P. 24).

So far I have acted as an academic philosopher reviewing a piece of academic philosophy. What is there in this book for those interested in educational research and theory? Very, very little, is the answer. In the Preface, the sentiment is expressed that the philosopher, being primarily a teacher, should be able to relate his abstractions to common experience; there is some internal inconsistency here, in that this is the last thing that Hinners himself does. This might produce the slogan, "Don't read to first-graders out of *Scientific American*". This, though a commendable maxim, was asserted and defended by one of history's first educational theorists, Plato, in the *Phaedrus*. It gains very little from being submerged by metaphysical ontology. One might find a message in his synthesis—"Be not so concerned with theory that one loses sight of actualities, nor so involved with those that one becomes inured to new theoretical possibilities". Again, valuable though this is, do we really need 267 pages of metaphysical ontology to "prove" it? I am at a loss to see who would find Hinners' book helpful. The professional philosopher will find more or less everything Hinners says said better elsewhere; the layman will be quite unable to penetrate the jungle of polysyllabic obscurities of which the book consists.

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AGRICULTURAL EDUCATION IN AUSTRALIA

by R. N. Farquhar, Australian Council for Educational Research

"Australian progress will depend largely on the intellectual investment the country is prepared to make in agriculture." So says Dr. Farquhar in his carefully written book "Agricultural Education in Australia". He might well have made his statement somewhat less modest by saying that total economic development in Australia, as in other countries, varies directly with the intellectual investment in agriculture.

The purposes of Dr. Farquhar's well documented book were to: (1) review the opportunities in agricultural education in Australia, (2) to set such provisions against an estimate of need and, (3) to make constructive proposals for program development. In the accomplishment of

these purposes he has been successful. His writing suggests a skilled craftsman at work.

This reviewer is handicapped by a lack of first-hand experience in agricultural education in Australia and thus may be pardoned for taking issue with certain philosophical premises inherent in Dr. Farquhar's excellent exposition. There seems to be an assumption that the community level secondary school should restrict its agricultural offerings to biology, with possibly an agricultural slant, but that training for the business of farming, including adult education for farm people, is a function only of post-secondary institutions. To accept such a premise is to remove from future program development the most effective channel in agricultural education so far as the farmer and his family are concerned. Until and unless the community schools are utilized fully in agricultural education—and not relegated solely to a college preparatory role—improved education opportunity in agriculture will likely not achieve the high goals Dr. Farquhar has set. More on this later.

Dr. Farquhar gets to the heart of the problem by identifying the basic problem of farming as being centered in management. The problems facing farmers are concerned primarily with adjustment to changing conditions, most of them economic. He properly points to the lag between research findings and their application as a challenge to agricultural education and he further illuminates the problem by specific suggestions for solution. The thirty-three recommendations made by Dr. Farquhar deserve careful consideration. It is this reviewer's judgement that Dr. Farquhar is aware of the historical axiom that no country achieves industrial progress without first carefully exploiting its agricultural resources. The major thrust of his recommendations (save for those dealing with secondary level education) are testimony to this fact.

One of the strong aspects of Dr. Farquhar's book is his emphasis on the need for maximum utilization of available resources in agricultural education. It may well be that this is the most significant pressure point in agricultural development and consequently national economic development. In his detailed analysis of the current situation Dr. Farquhar clearly exposes the framework around which this can be accomplished. One may note paranthetically that this problem of coordination of resources is universal and not limited to Australia.

Dr. Farquhar identifies and emphasizes a problem plagueing agricultural education around the world—the shortage of trained teachers. While Dr. Farquhar's focus is on extension personnel and post-secondary programs, he recognizes the need for more personnel trained in agricultural education however it may be described. In this connection, this reviewer viewed with some dismay the almost complete absence of any treatment of the problem of teacher education in agriculture. Considerable emphasis is given in the recommendations for program development, but none to teacher education. The considerable attention given to extension might have been shared with teacher education in agriculture

for secondary and post-secondary programs. Teacher education in agriculture is a function and responsibility that needs attention.

The more or less separate and distinct functions of agricultural research, instruction and extension, apparently current in Australia (and other countries), poses a real challenge and one that is identified by Dr. Farquhar's book. He correctly relates this to a crucial problem relative to providing adequate educational opportunities in agriculture. Here this reviewer must call attention to his background in a program where research, instruction and extension are more or less integrated thus making it very easy to agree with Dr. Farquhar's insistence on more complete unification of function and communication. However, if history is of any reliability as a guide, one may conclude that to look to colleges and universities for *practical* education for farmers is an exercise in futility. The major reason for this conclusion is the omission in Dr. Farquhar's otherwise excellent treatise of a strong plea for integration with the local community school and its necessary program of agricultural education.

For example, on page 290, Dr. Farquhar states "the needs of the future would be better met by the provision of secondary school biology courses 'taught with an eye on agriculture', with agricultural courses readily available at the post-school vocational training level. The agricultural courses could be more appropriately supplied by the agricultural college than the secondary school system." If one is interested in meeting the needs of farm operators and their families, it would seem to be simple logistics to enlist to resources of the local community school.

While there is no special emphasis given to the point one finds support in Dr. Farquhar's book for the thesis that both vertical and horizontal mobility must be maintained in an agricultural education system. While he does not say so explicitly, this reviewer is of the opinion that Dr. Farquhar would support the idea of keeping agriculture visible at the secondary level and recommend recognition of such training at tertiary levels. This is most valuable in organizing for maximum utilization of manpower. In Australia, as in other lands, the agriculture taught in secondary schools will be taught by alumni of the agricultural colleges and universities if it is to be done well. Parent institutions can help themselves by recognizing the contribution to agriculture of the secondary schools.

Dr. Farquhar is to be applauded for his recognition of the importance of farm management and business analysis instruction. Wherever and however it is done it is the most useful kind of education for people who operate production units in agriculture. Of particular significance is the description of the growth of independent farmer groups in an effort to obtain this type of education. This reviewer, having had some experience with this type of program, would agree entirely with Dr. Farquhar in his estimate of the importance of such programs. One might suggest that a vigorous program of farm management-business analysis

education seated in the local community school is worthy of consideration. Here indeed is the local secondary schools. The development of such programs will depend considerably on such perceptive writers as Dr. Farquhar.

Hopefully, it may be appropriate to conclude this review with an observation of the value of having ideas and comparing philosophies. To adhere to a common philosophy and the principles derived therefrom is in no wise to assume that practices must be identical. Practices and procedures are manifestations of an effort to "cut the cloth to fit the pattern", but this does not exclude the sharing of a common philosophy. Indeed, to do otherwise is to make one size of hat to fit every head.

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COMMITTEE ON EDUCATIONAL RESEARCH
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Editorial

The publication of this *Special Issue* devoted to the work of Jean Piaget and his associates is a response to the current interest and research activity in studies in Piaget's theories. This interest is mainly, but certainly not entirely, evident from consideration of the research projects being undertaken by graduate students in, particularly, educational psychology. Their interest is, of course, largely engendered by the emphasis given to Piaget by those responsible for guiding their graduate programmes.

The article by Professor Egon Mermelstein on Piaget's Clinical Method is timely and significant because it pinpoints one of the reasons for lack of interest in Piaget's theories (and for objection to them) in the past particularly in North America. Piaget's investigations were not conducted according to the statistical sampling criteria that have been the "hall mark" of behavioural science research since the rise of methodological behaviourism. A re-evaluation of research based on statistically drawn and tested samples from various populations is presently underway. This stems partly from dissatisfaction with the findings of research and partly (probably the greater part) from the tendency to reject the naive view of induction. Scientists and philosophers of science in both the natural and the social sciences under the influence of the logical empiricists and, notably, their critics have moved further and further from adherence to observation and inductive generalization as modes of discovery. The concept of scientific discovery conceived as the result of hypothetical conjecture based upon theoretical models and speculations that lead to testable situations that introduce the observational component has gained ascendency. This approach is not dissimilar to that used by Piaget.

Piaget is perhaps most widely known for his postulation of a chronological order of stages in concept development among children. That it is the *order* in which various types of concepts are attained by children rather than the *specific* ages at which they occur that is important is too often overlooked by the critics. Consequently, much seemingly futile and pointless effort has been devoted to showing that concepts which Piaget said were attained at a certain age appear at some other age. The important point is that the development of one type of concept is preceded by the development of another type and that maturation is the

determining agent rather than education. The replications printed in this issue tend to support this view.

The initial section of this issue is given to a brief explanation of Piaget's thesis which, because of space limitations, does less than justice, a short article in which André Côté makes available a review and comment on one of Piaget's more recent publications which is not yet available in English, and the note on the clinical method previously referred to. These papers do say some specific things about Piaget but, more importantly, they also show that understanding his theoretical position is prior to interpreting his empirical research. In other words his research findings are not generalized to formulate the theory but designed to confirm his previously formulated theoretical model.

Of the four articles in the *Replications* section that of Mermelstein and associates is the most significant. These investigators designed their study to test claims made by several researchers who had developed techniques for inducing the concept of conservation. The results cast doubt upon the validity of these claims and provide evidence in support of Piaget's conclusions. The other articles in the section are replications, with modifications in design, of experiments conducted by Piaget and all tend to confirm his view. The factor analytic study carried out by O'Bryan and MacArthur is a sophisticated study of Piaget's reversibility dimension in which it is examined in a wider context.

The two articles in the final section are perhaps only peripherally related to Piaget's psychological position. In the former Collins attempts to show the logical structure of Piaget's theory and relate it to a method of systemizing theoretical positions that has been fruitful in the philosophy of science. Although her assertions may not be wholly justifiable the attempt does serve to underline the view that Piaget begins from a theoretical position. The other article is concerned with the degree to which Piaget is known and accepted in the Soviet Union.

The decision to produce this special issue was ambitious. The degree of success attained can be determined only by the degree to which it captures the interest of readers. The editorial staff makes no claim to success but remains content to claim that an endeavour has been made to satisfy a current need and provide some motivation for research. At least it has provided publication opportunity for papers which otherwise may not have been seen by any but their authors.

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This paper is the result of an attempt to summarize the essential features of Jean Piaget's theoretical position with respect to human development. Much of the relevant empirical and theoretical data have been omitted in an attempt to produce an understandable and not too voluminous synthesis. Direct references to the writings of Piaget and his co-workers have been omitted largely because the account presented here is a distillation and interpretation of many scattered writings. Perhaps the most glaring omission is that of Piaget's later work on perception—an omission which is rectified by the inclusion of A. Côté's analysis of this work in the present issue of this Journal.

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Jean Piaget's Developmental Model: Equilibration-Through-Adaptation

The Man

No descriptive and exploratory account of the work of Jean Piaget would be complete without some consideration of the man himself—of a man who over the past four decades has poured such a wealth of information and theorizing into the coffers of psychological knowledge that, as yet,only a small part of it has been assimilated by his audience.

Piaget was born in Neuchatel, Switzerland on August 9, 1896. The often related instances of his precocity include his publication of a scientific paper at the age of ten—a one page note relating to a partly albino sparrow which he had observed. Soon thereafter he volunteered as a laboratory assistant in the local museum of natural history. By 1930 he had published about twenty-five papers on zoological topics—parti-

cularly on molluscs. He studied at the University of Neuchatel where, at the age of 22, he received a doctorate in the natural sciences (with a dissertation on molluscs). During the next two years he worked at various centres in Europe: at Bleule's clinic, at the Sorbonne, at the Laboratories of Wreschner and Lipps and eventually under the direction of Simon in Binet's laboratory at a Paris grade school. It is probably this latter position that marks the beginning of his interest in the development of children. His first series of articles in this area appeared in 1921 and 1922. These were followed in 1923 by his book—*Language and Thought of the Child.* Since then, he and his collaborators have published more than 20 books and over 180 major studies, the bulk of which are found, written in French and untranslated, in *Archives de Psychologie,* of which Piaget is currently co-editor. In addition he is co-editor of the *Revue Suisse de Psychologie,* director of the Institute des Sciences de l'Education, founder of the Centre d'Epistemologie Genetique, and director of the Bureau Internationale de 1'Education, an affiliate of UNESCO.

The Theory

Orientation

Consistent with Piaget's early training and interests, the position he advances stems very directly from a biological orientation. The central questions in biology have been concerned with the classification of various species in phylogenetic order, and with the development of adaptive mechanisms and processes in these species. Piaget's attempt to relate these same questions to human ontogeny—that is, to development from birth to maturity—has resulted in a theoretical position which purports to explain the central features of development. Indeed, the really essential aspects of Piaget's theoretical position are reducible to the logical implications of these questions. Accordingly, this paper examines the Piagetian position as it derives from these biological considerations. This is followed by a brief summary of Piaget's description of human ontogeny.

Adaptation

Any theoretical account of human development must be concerned with the progress made by individuals in understanding their environment and in their ability to cope with it. Whether or not a theory uses the term adaptation, if it deals with human development, then it is concerned with at least some aspects of adaptation insofar as the term denotes changes in the way an organism deals with the environment—changes in the organism *per se,* or both. Piaget has evolved a theoretical system which explains development directly in terms of the adaptative

process and in terms of progressively changing intellectual makeup. The inferences he makes regarding human development are based on observed behavioural events (content). From the fact that there is behaviour, and that it is *this* particular behaviour, he infers that there must be some organized or organizational properties of the intellect which determine behaviour (structure). The crucial question then becomes one of discovering how structure arises, how it functions, and how and why it changes. Initially he assumes that an individual is born with the capability to perform certain simple acts, ordinarily referred to as reflex acts. Thus a child can, if given the opportunity, suck from a nipple or grasp an object pressed into his palm. Initially, therefore, mental structure is defined in terms of these simple acts. Whenever an object is presented to a young child and he acts toward it in terms of some activity which he has already mastered (e.g., a nipple is placed in a child's mouth and he sucks on it) he is said to *assimilate* the object (or at least some aspects of the object) to the sucking activity. This overt activity together with whatever structural connotations it has is termed a *schema.* It is readily obvious that when Piaget is describing the exercising of a pre-existing schema, he is talking about only one aspect of adaptation, albeit, an essential aspect. The other aspect of adaptation is the one which allows for the modification and growth of the organism. Again, it is readily apparent that before long, an infant will suck not only short 'bulb' nipples but long thin ones, or even objects that are not nipples. The significant thing here is not so much that new or different objects are being assimilated by the sucking schema, but that the activity of sucking is no longer the same. The mouth and tongue are held differently for different objects, and the movements performed are different if the object sucked provides food or if it does not. There is, in other words, an *accommodation* of the organism (or more specifically, of an activity of the organism). to the environment—and consequently there is a change in the structure (or intellectual make-up) of that individual. It is, then, these two processes, assimilation and accommodation, which define adaptation and which will continue, throughout life, to serve as the *modus operandi* of intellectual growth.

Intelligence

To facilitate interpretation of the preceding section a brief look at Piaget's views on intelligence is necessary. Unlike many of his contemporaries who have viewed intelligence as a relatively fixed but nebulous quantity or quality, Piaget sees it as being inherent in the activity of individuals.

Intelligence is not only observable through overt behaviour, but it *is* this behaviour together with the structures which direct and determine the behaviour and utilization of the structures in the face of en-

vironmental demands. The whole concept of intelligence-in-action can be diagrammed as follows:

CONTENT

STRUCTURE

FUNCTION

ASSIMILATION ACCOMMODATION

ENVIRONMENTAL DATA

The model presented above can be arrived at logically in two ways. One can begin with content, which is behavioural data, and infer from this data that certain structures are present in the child's mind which lead to the appearance of this behaviour. Alternatively, one can look at the environment and at the behaviours which result from an attempt to adapt to it. As has already been explained, the processes of adaptation are defined by the functional invariants assimilation and accommodation—"functional" because they are the mechanisms of human intellectual functioning; "invariants" because as functions they do not change throughout development.

Structure

The account of Piaget's theoretical position presented thus far serves to outline his attempt to address himself to the question of how human functioning tends toward adaptation. His second chief concern stemming from biology has to do with the classification and organization of behaviour. Piaget sees human intellectual development as marked by a series of ordered qualitative changes—changes which are brought about through adaptive interaction with the environment, but which are defined primarily in terms of changing structure. It is the nature of this mental structure, as he has described it, which leads him to define a series of developmental stages. The bulk of that which has been written about Piaget's theory has to do with the characteristics of these stages rather than with those aspects of the system upon which the stage concept is predicated. These stages are outlined later.

Equilibrium

Central to Piaget's developmental position is his concept of *equilibrium.* In order to account not only for the development of increasingly complex intellectual structures, but also in order to explain the organizational properties of these structures, Piaget utilizes what is yet a rather nebulous concept, that of equilibrium. At the simplest level, equilibrium denotes a state of balance between assimilation and accommodation. It

is evident that the preponderance of one or the other of these functions with respect to a given object in the environment will result in less than optimum adaptive behaviour. For example, a preponderance of assimilation (which, incidentally, characterizes the early "play" behaviour of children) will lead to an unrealistic interpretation of the environment. That is, when a child uses a stick, a broom and a spoon as guns he is assimilating these objects to the "gun" schema (or structure) without regard for their more important non "gunlike" attributes. When, on the other hand, there is a preponderance of accommodation (as is illustrated by a child's primitive behaviour) interaction with the environment is less likely to be meaningful. It seems obvious that if a child does not assimilate at least some aspects of the environment to established structures, this environment will be relatively meaningless to him.

When Piaget says that equilibrium is the state towards which all cognitive functions tend, he is, in fact, saying that development is to a considerable degree governed by a need to arrive at meaningful and realistic understanding of, and ability to cope with, the environment. And this relationship *vis-a-vis* the environment will prevail, according to Piaget, to the extent that there exists a state of equilibrium between assimilation and accommodation.

At a more complex level, equilibrium signifies more than a simple balance—it is a state of development with respect to mental structures where external distrubances can be compensated for within the system of structures without either destroying the essential logical properties of that system or distorting the reality which is being reacted to. Equilibrium can therefore be seen as a motivational concept of first importance in the Piagetian system. Insofar as there is a need to maintain some sort of equilibrium—in other words, a need to understand the environment and to reduce external disturbances—the individual will continue to function as long as he is in a state of disequilibrium. And just as important from a motivational point of view is the thesis that this functioning will be aimed toward the elaboration and stabilization of structures in equilibrium.

The Stage Theory

Piaget's concern with human adaptive processes and with the structure that both influences and results from adaptation is evident in his account of human development. He describes human ontogeny in terms of the logical progression of intellectual structures through development. In other words, his apparent concern with describing what a child can and cannot do at different ages stems not so much from a simple observational and reporting emphasis as it does from the theoretical considerations referred to earlier in this paper, which are not only suggest-

ed by developmental data but which also provide a logical framework for the understanding and explanation of this data.

The following sections of this paper deal with Piaget's description of the four major stages which comprise the human developmental sequence the sensori-motor stage (birth to 2 or 3 years); preoperational thinking (2 or 3 to 7 or 8 years); concrete operations (7 or 8 to 11 or 12 years), and formal operation (11 or 12 to 14 or 15 years). This account is admittedly and necessarily incomplete. Hopefully, however, the essential features of each stage have been included. It is important to note that the ages given for each stage are merely approximations. It is not the age at which structures appear but the order of appearance which is of importance.*

The Sensori-Motor Stage (0 to 2 or 3 years)

The newborn child's intellectual structure is defined in terms of reflexes. The child's understanding of his world at this stage will be limited to the actions that these reflexes allow him to perform on his environment. In other words, his world is a world of the here and now which is defined almost entirely in terms of actions. The young child does not separate an object from the actions which he performs on this object. This type of representation of reality is evident in that he does not define objects in terms of the attributes which he will use later to identify them. A ball is not simply a round object—it is "to play with".

The simple reflexes (reaching, grasping, sucking) that the child is born with are called schemata. Piaget says that there is an intrinsic for schemata, once established, to perpetuate themselves through functioning. For this reason all objects that can be assimilated by a schemata will be reacted to. Initially schemata are discrete and unrelated. Eventually, as a result of interaction with objects, schemata will become coordinated so that more than one activity can be performed sequentially in relation to the same object. In other words, the child will now be able to reach for, grasp, bring to his mouth and suck an object. There is still, at this early age, no distinction between the activity and the object. Indeed one of the most important achievements of the sensorimotor period of development will be the establishment of what Piaget calls the "object concept". This involves the simple realization that objects have a permanence and an identity of their own and that they continue to exist even when they are not being perceived by the child.

Early in the sensory motor period there is no language or use of symbols. According to Piaget language will develop first through the internalization of activity. It is not until the child has internalized an

*A point which is too often overlooked—subsequent investigators have devoted much effort to showing that Piaget's ages are faulty (Ed.).

activity related to an object that he can think of that object when he is not acting on it. It is this internalization of activity which sets the stage for the development of the intellectual structures which will characterize the later periods of development. Once an activity has become internalized the child has some sort of image which he can use in a symbolic sense. It is then a relatively simple matter to substitute a verbal symbol for this image, and this will be the beginning of language.

By the end of the sensori-motor period the child has acquired language, achieved the object concept, and can represent to himself the outcomes of actions before they occur. His thinking is still characterized by extreme ego centricism. His world is still the world of the here and now and objects continue to exist only in relation to himself. Through continued sensori-motor assimilation of and accommodation to the environment, however, the stage has been set for later intellectual development.

Pre-operational Thinking (2 or 3 to 7 or 8 years)

The term operation is a relatively important one in Piaget's developmental system. It refers to an action which is not only internalized but reversible as well. An action is reversible when the child realizes that an inverse action necessarily and logically nullifies it. As is obvious from the term pre-operational, the child from ages two to seven has not yet reached the level of operational thinking.

Piaget divides the pre-operational period into two sub-periods; the first he calls pre-conceptual thinking. This lasts from ages two to four. From ages four to seven the child is in the period of intuitive thinking. The first of these periods, the pre-conceptual, is characterized by the fact that the child at this stage does not have a true concept of class. He does have some sort of a pre-concept, which enables him to identify objects which belong to classes but which does not allow him to group objects into the classes to which they belong. Piaget illustrates this by refering to an experience he had with his young son while on a walk in the woods one day. Shortly after they began the walk the boy saw a snail and pointed out to his father that here was a snail. When, a short while later, they saw another snail the boy said, "Here is that snail again." For him all snails were one and the same. Among the many instances of this type of reasoning in young children is the fact that a three year old child can see four different Santa Clauses in four different stores on the same day and not for a moment suspect that there might be more than one Santa Claus.

Another characteristic of this stage of development is that the child's thinking is neither inductive nor deductive, but rather transductive. That is, the child does not reason from the general to the particular (deductive) nor from the particular to the general (inductive) but reasons

instead from particular to particular. An extreme illustration of this type of reasoning might be the following:

Cows eat grass.
Goats eat grass.
Therefore goats are cows.

During the next substage of pre-operational thought, the intuitive stage, the child's thinking is still bound to perception. He now has some idea of class membership but cannot apply logical rules to classification. Probably the best illustration of the role of perception in the child's thinking at this stage, and the lack of logic in his thinking comes from Piaget's experiments on conservation. While the child has now developed an object concept and has achieved some understanding of the quantitative attributes of objects he does not realize that these quantities will not change unless something is added to or taken away from the objects. For example, if a five year old child is presented with two balls that are made up of equal amounts of plasticine he will admit that they do in fact have the same amounts. If one of the balls is then lengthened into a sausage-like shape and the child is asked whether the "sausage" and the ball still have the same amount of plasticine he will probably say that the "sausage" has more plasticine in it because it is longer or that it has less plasticine in it because it is thinner. Not only is the child being misled by the perceptual features of the objects before him, but in addition, he is not applying the logical operations which will characterize his thinking during the period of concrete operations.

Concrete Operations (7 or 8 to 11 or 12 years)

The key feature of the period of concrete operation is action on the environment which becomes internalized and results in the ability to classify, to order and to work with numbers. These abilities are the direct result of ordering, dissociating, combining, and setting up correspondences with real objects. The child's intellectual structure at this stage will be defined in terms of operations (internalized reversible actions) which are coordinated into systems to which certain logical laws apply. In other words the child's thinking can no longer be as ego-centric or as perception-dominated as it was in his earlier periods of development because it must now conform to the following rules of logic:

1. Closure—the child realizes that the sequential application of two operations forms a third operation. In a mathematical sense adding two and three yields a third number, five.
2. Reversibility—for any operation there exists an inverse cancelling operation. For example, adding three to two yields five, but subtracting three from five cancels the first operation and the result is again two.
3. Associativity—if any three or more operations are combined it

makes no difference what the order of the combination is. For example, two plus three, plus four is equal to four plus three plus two.

4. Identity—this is simply the awareness that there are operations that leave objects unchanged. For example, two plus zero is equal to two.
5. (a) Tautology—the repetition of a relation or a class does not change it. For example, the class of all men plus the class of all men, etc., is equal to the class of all men.
   (b) Reiteration—repetition of a number produces a new number. Three plus three plus three is equal to nine.

While the examples given for these five rules which govern concrete thinking have been related to numbers, illustrations can also be drawn from the realm of non-mathematical thinking. Referring back to the conservation of mass problem described earlier, it can be shown that when a child has achieved reversibility or identity he will have acquired conservation. Using reversibility when faced with the conservation problem, if the child reasons that there now appears to be more plasticine in the "sausage" but this "sausage" could be transformed back onto the plasticine ball and there would still be the same amount of plasticine in it, or alternatively that the other plasticine ball could be transformed into a sausage in which case it would be perceptually and actually identical to the given sausage, he would then be able to demonstrate conservation of mass. Or, using identity, the child might simply reason that nothing has been added to or taken away from either of the plasticine in both. Indeed the child at the end of the period of concrete operation has acquired all of the important conservations—mass, number, weight, volume, length, distance, and area.

While the child at the concrete level of operations can deal with classes, numbers and relations, and while his thinking is governed by some of the rules of logic it is still restricted when compared to the level that will be reached in the period of formal operations. In the first place his thinking does not possess complete generality. The various conservations are tied to concrete separate systems. The child cannot, once he has acquired these five rules of logic, apply them to all types of conservation problems. He will acquire conservation of mass around the ages of 7 or 8, that of weight around the ages of 9 or 10, and that of volume only at the end of the period of concrete operations. In addition, his thinking deals only with real and visible objects or with objects that are at least capable of evocation. He does not deal with the hypothetical: he cannot reason from the possible to the actual, or from the actual to the possible. Also, his thinking deals with classes but does not take into account the product of these classes. In other

words while he can combine two separate classes into all possible combinations, he will not then systematically combine the products of these combinations.

Formal Operations (11 or 12 to 14 or 15 years)

The major acquisition of the period of Formal Operations is the child's ability to deal with the hypothetical as opposed to the real and concrete. Piaget describes the structures-in-equilibrium characteristic of the adolescent in terms of a logical model which illustrates all possible transformations and combinations of any two (or even three) propositions (statements that can be true or false). What this means, in effect, is that the adolescent can now think hypothetically in a logical manner. He has become freed from the necessity of considering only the real and concrete. His thinking has become potentially completely logical and is characterized by rules which, unlike those of the period of concrete operations, apply to the system as a while. This period is the culmination of an adaptive process which began at birth, and which, through the processes of assimilation and accommodation, has resulted in the development of intellectual structures which are theoretically as sufficient for understanding and coping with the environment as they will ever be.

Logic

A discussion of Piaget and his work would be incomplete without some mention of his use of models derived from Logic.

Piaget's use of logic in psychology is concerned with the explantion of psychological "facts" by reference to the algebra of logic. He has not attempted to explain the formation of structures in the child's mind through the use of logic, but rather, has endeavoured to show that a more complete and clearer understanding of thinking could be obtained by drawing a parallel between pure logical systems and the child's mind where the characteristics of these logical systems become evident.

Piaget's use of logic is not restricted to the level of formal operations but applies as well to earlier periods of development. There is obviously an analogy to be drawn between the thinking characteristic of the concrete level of operations and a logical system defined by the five laws that govern thought at this stage. At the same time, however, it is partly by drawing this analogy that the limitations of concrete thinking are brought to light—and it is possible, at least *a posteriori,* to extend the logical system which provided the analogy for concrete thinking and thereby strive at a prediction of what the state of the mental structures that define formal thought will be. Indeed, Piaget's developmental system can be interpreted as an attempt to describe the evolution of logi-

cal structures in the child—a description which could well have been blueprinted *a priori* by his awareness of the possibility of developing a coherent model of development through the use of a framework derived from the realm of logic.

The logical models utilized by Piaget are based on the language of Boolean algebra—an algebra which is sufficient to represent both classes (entities that have similar properties) and propositions (statements that can be true or false), together with the relationships that can exist between classes or propositions and the transformations that can be effected on them. It is not necessary to understand the mathematico-logical models in order to appreciate the contribution these can make to a system which is concerned largely with the development of the ability to deal logically with an environment made up of classes and propositions. It follows that the intellectual structures which define concrete thinking can be described in terms the logic of classes, while those pertaining to formal operations can be described in terms of propositional logic.

More specific illustrations of Piaget's application of logic are provided by the number of his experiments. In one of these, subjects are presented colourless liquids will yield a yellow colour. Solving this problem systematically involves testing the 16 possible combinations. The child at the formal level of operations will do this while a younger subject will likely try a smaller number of combinations. The 16 combinations are analogous to the logical model which Piaget describes in connection with formal operations.

Summary

Piaget's developmental position, as outlined in this paper, involves essentially the application of an equilibrium-through-adaptation model to the description of the qualitatively different intellectual make-up of the child at different stages of development. Accordingly, while the descriptive data pertinent to the stages are relatively unique, extremely interesting and very pertinent to an educational application of the position, it is the adaptation model which is most crucial to the theory, and which has been emphasized in this paper. It must be kept in mind, however, that much of Piaget's four decades of work in this area (and many of his books and articles) has been devoted to the experimental illustration and verification of the central model. Among the many specific areas of research not mentioned in this paper are time, number, movement, space, causality, geometry, chance and perception. Only a book-length review could hope to do justice to all of these topics—and only such a review could adequately transmit the depth and comprehensiveness of the work of Jean Piaget.